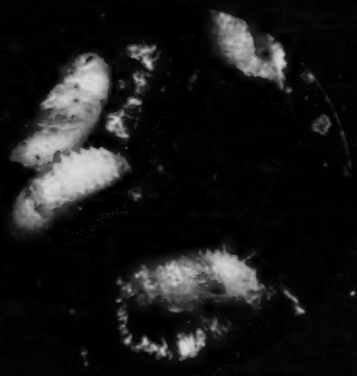
2007 Annual Report

Forest Health in Alberta



Alberta

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2007 Annual Report

Forest Health in Alberta

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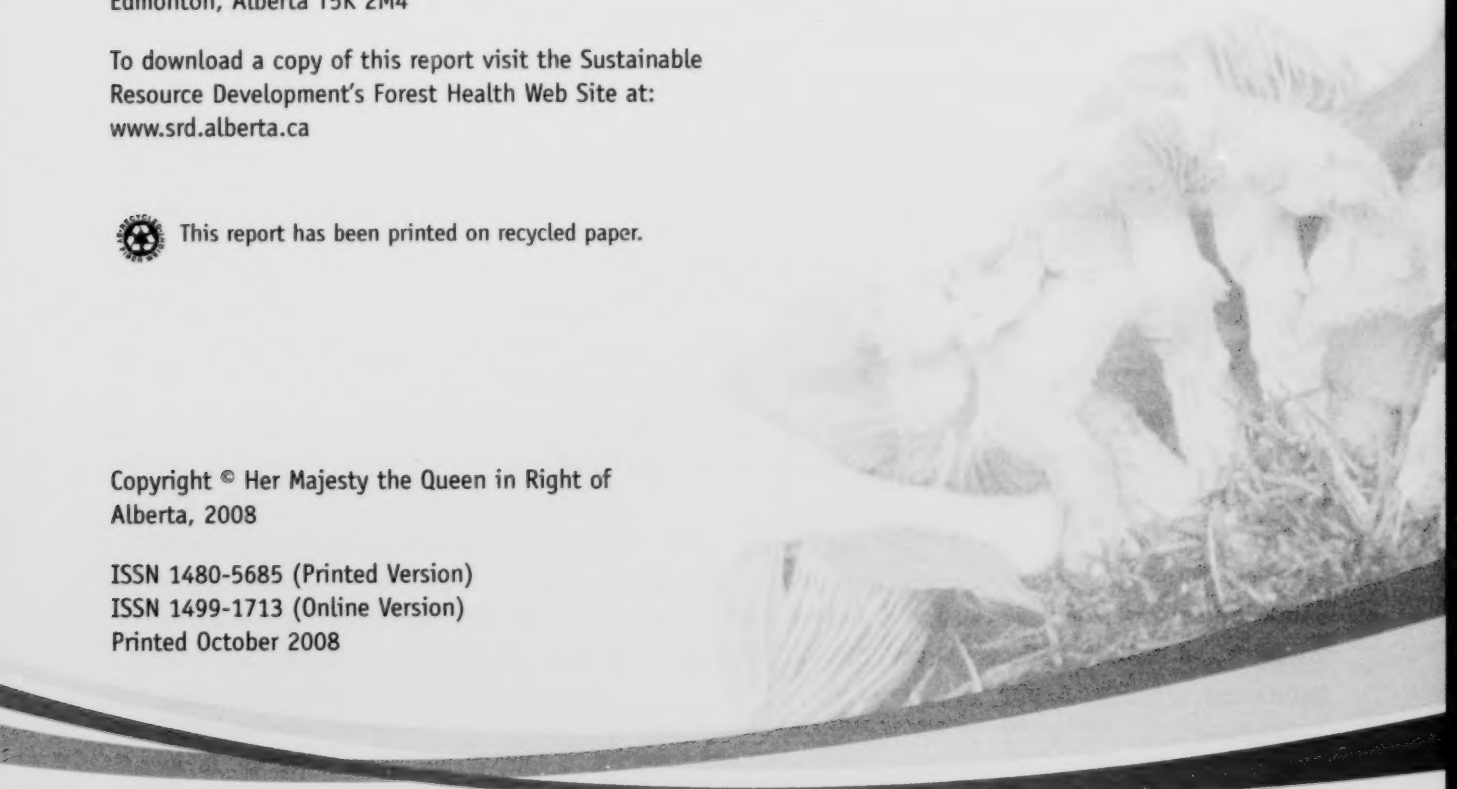

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ISSN 1480-5685 (Printed Version)
ISSN 1499-1713 (Online Version)
Printed October 2008

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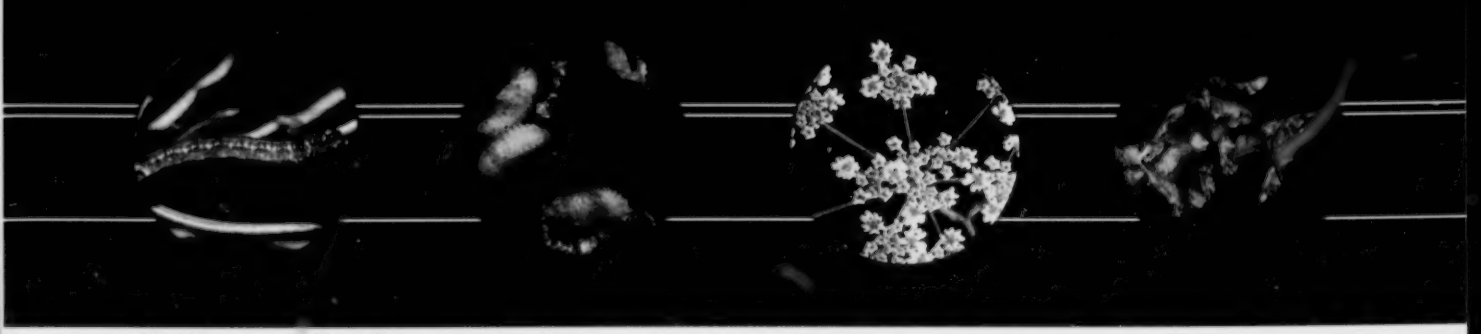

Acknowledgements

Sunil Ranasinghe compiled this report with contributions from Mike Undershultz (Forest Invasive Alien Plants) and Anina Hundsdoerfer (Mountain Pine Beetle); This document is based on the reports submitted by the following individuals:

- Mike Maximchuk, Tom Hutchison, Christie Ward, Brooks Horne, Devin Letourneau, Dale Thomas, Seena Hendel and Trisha Stubbings (Forest Health Officers, Alberta Sustainable Resource Development);
- Mike Jenkins and Mark Wartenbe (Biological Sciences Technicians of the Community Services, City of Edmonton);
- Roger Brett (Supervising Forest Health Technician, Northern Forestry Centre, Canadian Forest Service, Edmonton, AB);
- Janet Feddas-Calpas (Coordinator of the Society to Prevent Dutch Elm Disease); and,
- Les Weekes (Forest Officer, Cypress Hills Inter-Provincial Park).

Support for and/or participation in the Forest Health Program by the following individuals and organizations is greatly appreciated:

Mountain Pine Beetle Management Program

- Dr. Allan Carroll, Dr. Barry Cooke, Dr. Terry Shore, (Research Scientists) and Greg Pohl (Insect and Disease Identification Officer) of Canadian Forest Service, Natural Resources Canada for providing technical expertise for the program.
- Duncan MacDonnell (Public Affairs Officer, Communications, Alberta Sustainable Resource Development) for information on media events.

Northeast Forest Health Program

- Millar Western Forest Products Ltd. and Northlands Forest Products Ltd.
- Carlie Brown; Ed Barnett; Alex Holod; Dave Moseley; Dennis Froese;
- Martin Robillard; Steven Stryde

Northwest Forest Health Program

- Manning Diversified Forest Products and Tolko Industries Ltd. – High Level
- Danny Brown; Natalie Butler (née Henneberry); Hope Klein; Nicolas Martel

Maps

Aaron McGill (GIS Specialist) and Brad Tyssen (MPB GIS Specialist), Forest Health Section, Alberta Sustainable Resource Development

Photos

Duncan MacDonnell; Mike Undershultz; Marian Jones, Martin Robillard; Tom Hutchison

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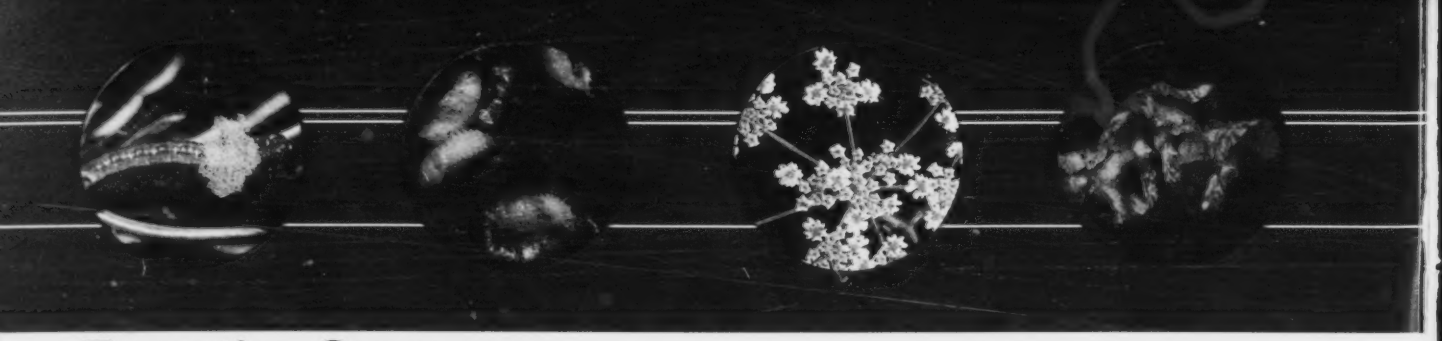
Design and Publishing

Gwen Edge (Graphic Designer, Communications, Alberta Sustainable Resource Development)



Executive Summary

This report contains details of forest pest surveys; forest pest and invasive plant management programs; programs to increase awareness and provide training on forest health; and, research and development carried out under the Sustainable Resource Development's Forest Health Program in 2007.

Given below is a summary of the occurrence of major forest pests surveyed in Alberta in 2007:

Pest Species	Extent of Infestation
Spruce budworm	142,832 hectares
Western spruce budworm	17,678 hectares
Mountain pine beetle	108,365 trees
Forest tent caterpillar and other aspen defoliators	3,255,338 hectares

The spruce budworm defoliated area in the province increased nearly three-fold from an estimated 36,771 hectares in 2006 to 142,832 hectares in 2007. The severely defoliated area increased over six-fold from 7121 hectares to 53,636 hectares. Spruce budworm control measures have to be undertaken in the near future if trees severely infested for several consecutive years have to be kept alive. The western spruce budworm defoliation in Douglas fir dominated forest stands in the Porcupine Hills area covered an estimated 17,679 hectares in 2007.

In July 2006, a massive influx of mountain pine beetles from British Columbia scattered beetles over a wide area in northern Alberta. This influx resulted in faders occurring in 2007 as far east as Lesser Slave Lake. During beetle management operations 108,365 currently infested trees were detected and 89,704 such trees were removed.

Aspen defoliation, predominantly by the forest tent caterpillar, was scattered over an estimated 3,255,338 hectares of provincial forested Crown land. This was a 44.4% reduction compared to the 5,851,155 hectares affected in 2006. Bruce spanworm, linden looper and large aspen tortrix were among the other defoliators of aspen. No gypsy moths were collected in the pheromone-baited traps deployed by Alberta Sustainable Resource Development as a part of the gypsy moth monitoring program coordinated by the Canadian Food Inspection Agency.

White pine blister rust infected several white bark pines, a species at risk, in Willmore Wilderness Park. Mature pines in Bragg Creek area were affected by Armillaria root disease.

Urban forest trees in Edmonton were infested by defoliators, bark beetles, sucking insects, wood borers and gall makers. Dothiorella wilt continued to affect elm trees in Edmonton. The American elms in Edmonton remained free of Dutch elm disease; only one beetle vector of this disease was trapped in Edmonton. No exotic pe , were detected in the monitoring traps set up by the City of Edmonton in collaboration with the Canadian Food Inspection Agency.

SRD, as a member of the Interdepartmental Invasive Alien Species Working Group, participated in advancing the development of an Invasive Alien Species Management Framework and a Risk Assessment Tool. SRD also standardized and consolidated invasive plant information. A Geographic Land Information Management and Planning System

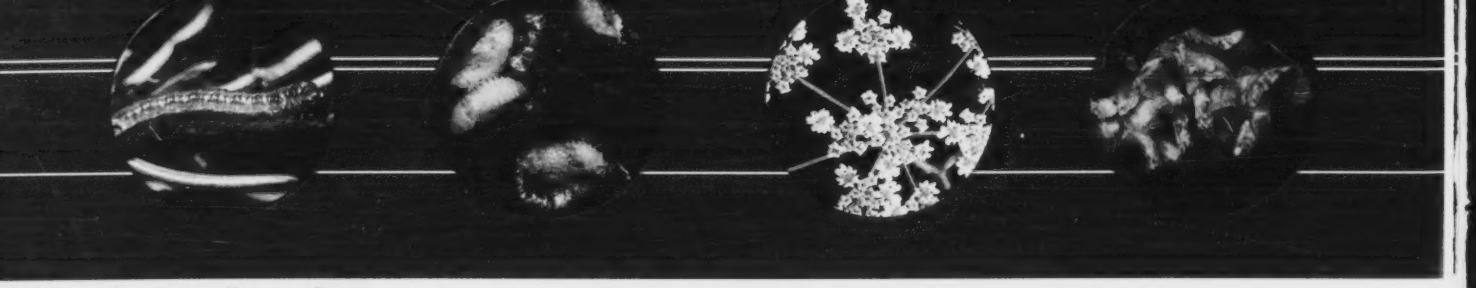
will be used to store this information. SRD produced composite maps showing provincial distribution of common alien invasive species. The SRD staff at the Area level carried out programs to increase awareness and provide education; initiate cooperatives, survey and control invasive alien plant species.

In the 2006/2007 mountain pine beetle year, 108,365 faders were detected during the surveys carried out in the provincial forested Crown land. Between 2006 August and 2007 July, 89,704 green attack trees were removed under the Level I response (single tree or small patch removal). With the Level II response (harvesting of infested stands) forest companies removed 816,869 cubic metres of pine wood from infested stands during this period.

Several surveys were carried out in 2007 under the "Alberta Forest Pest Outbreak Warning System" to predict the risk of forest pest outbreaks occurring in 2008 in Alberta. The risk of new spruce budworm outbreaks occurring in 2008 is moderate to high in northeast Alberta and low to moderate in northwest and southwest Alberta. Egg mass surveys indicated very high potential for severe defoliation by the western spruce budworm in 2008 in the Porcupine Hills area. R-values, a measure of the potential increase of the mountain pine beetle populations, were determined in currently infested areas of the province. R-values highly varied but in general were high in the southwest and relatively low in northern Alberta. The green to red ratio was also high in southwest Alberta indicating higher level of MPB population in 2008. In spite of low R-values, the green to red ratios in Foothills, Lesser Slave and Peace areas were high indicating higher population levels in these areas. Thus, overall MPB populations are expected to increase in 2008 in southern Alberta and in some areas in northern Alberta. Egg mass surveys in 2007 predicted severe defoliation in 2008 in most of the forest ten caterpillar infested areas in northeast Alberta. No gypsy moths were caught in pheromone-baited traps deployed at 65 locations by the SRD.

The annual report, Bugs and Disease Newsletter and the Beetle Bulletin were published in 2007 to educate and increase forest health awareness of the stakeholders and the general public. The 11th Annual Integrated Forest Pest Management Forum organized by the Forest Health Section was well received by the attendees representing the industry, academia, SRD workers and forest health research community. The 15th Annual Alberta/British Columbia Forest Health Workshop organized by the Canadian Forest Service was well attended by the forest health community of the two provinces.

In 2006/07, SRD supported 15 research projects on mountain pine beetle. These projects covered a variety of topics ranging from ecology, genetics, impacts, management and population dynamics of the MPB. In 2007, technologies to predict severity of defoliation by the forest tent caterpillar and the western spruce budworm were transferred to regional forest health personnel.



Introduction

This report on the forest health program of Alberta in 2007 contains details of the following:

- major forest pests monitored annually and forecasts on their occurrence in 2008,
- mountain pine beetle pest management programs carried out in 2006/2007 beetle year,
- programs on invasive alien plants in the Green Area,
- programs to increase forest health awareness and to provide forest health education,
- forest health related technology development.

The intent of this report is to:

- keep the forest health stakeholders, including the general public, informed; and,
- document a record of the 2007 forest health program in Alberta.

This report contains, within limits of availability, details of forest health programs in forested lands in Alberta managed by the following authorities: the Department of Sustainable Resource Development (SRD) that has the mandate on tree health in the Crown-managed forested lands in Alberta; the Department of Tourism, Parks and Recreation with the mandate on tree health in provincial parks, wilderness areas and protected areas; the federal agencies that manage tree health within national parks and native Indian reserves; the municipal governments, Metis settlements and private land owners who look after tree health in their respective lands.

SRD's forest health mandate is carried out by effective detection and monitoring of forest pest outbreaks and implementation of appropriate pest management strategies that promote forest sustainability and recognize joint responsibility with forest industry. The provincial headquarters of SRD administers and coordinates the forest health program that is delivered by the Corporate Areas (Appendix I). The Forest Health Officers manage operational aspects of forest health programs.

The mountain pine beetle (MPB) was the predominant forest pest in Alberta in 2007. The details of the MPB program from the time beetle flights occurred in 2006 to the time of new beetle flights in 2007 are provided in this report.

This report contains details of major forest pests that are routinely monitored in Alberta. Other forest pests also occur in the province. Details of these other pests are reported in this document only if they were monitored in 2007.

The forest pest surveys carried out by SRD are conducted for operational purposes and do not cover the entire forested area of the province. Although every effort is taken to ensure that the information reported here is accurate its integrity is not guaranteed.

[1] The information presented in this report is made available for personal use and not intended for commercial use. Written permission must be obtained from the Manager, Forest Health Section, prior to using this information in any format in any publication (telephone (780) 427-8474 and facsimile (780) 427-0084).

Forest Pest Conditions in 2007

Forest Pests in Natural Forests

Spruce Pests

Spruce Budworm
Choristoneura fumiferana (Clemens)

The spruce budworm outbreak that began in 1987 in northern Alberta reached its peak in 1995 and decreased to its lowest level in 2005 (Figure 1). This outbreak collapsed in most areas in 2005 although remnants persisted in northeast Alberta.

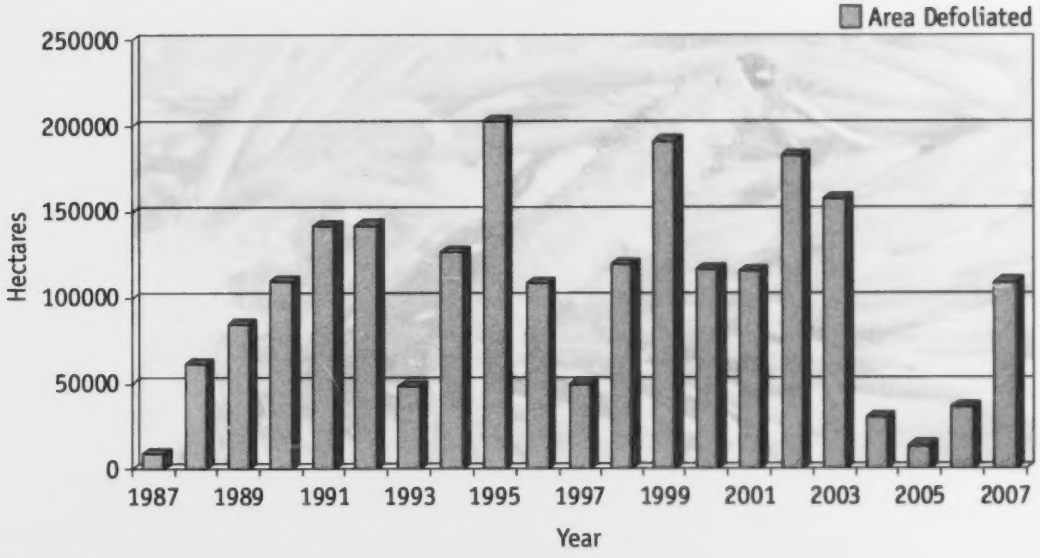


Figure 1
Number of hectares annually defoliated by the spruce budworm on forested Crown land of Alberta, 1987 – 2007.

The spruce budworm defoliated area began to increase in 2006 (Figure 1). In 2007, the increasing trend continued with the spruce budworm defoliating an estimated 108,758 hectares of forested Crown land. This was a 196% increase in the defoliated area compared to 36,771 hectares defoliated in 2006 (Figures 2, 3 and Table 1). In addition, spruce budworm defoliation was scattered over 34,074 hectares in Wood Buffalo National Park (Figure 3) compared to 33,591 hectares defoliated in 2006.

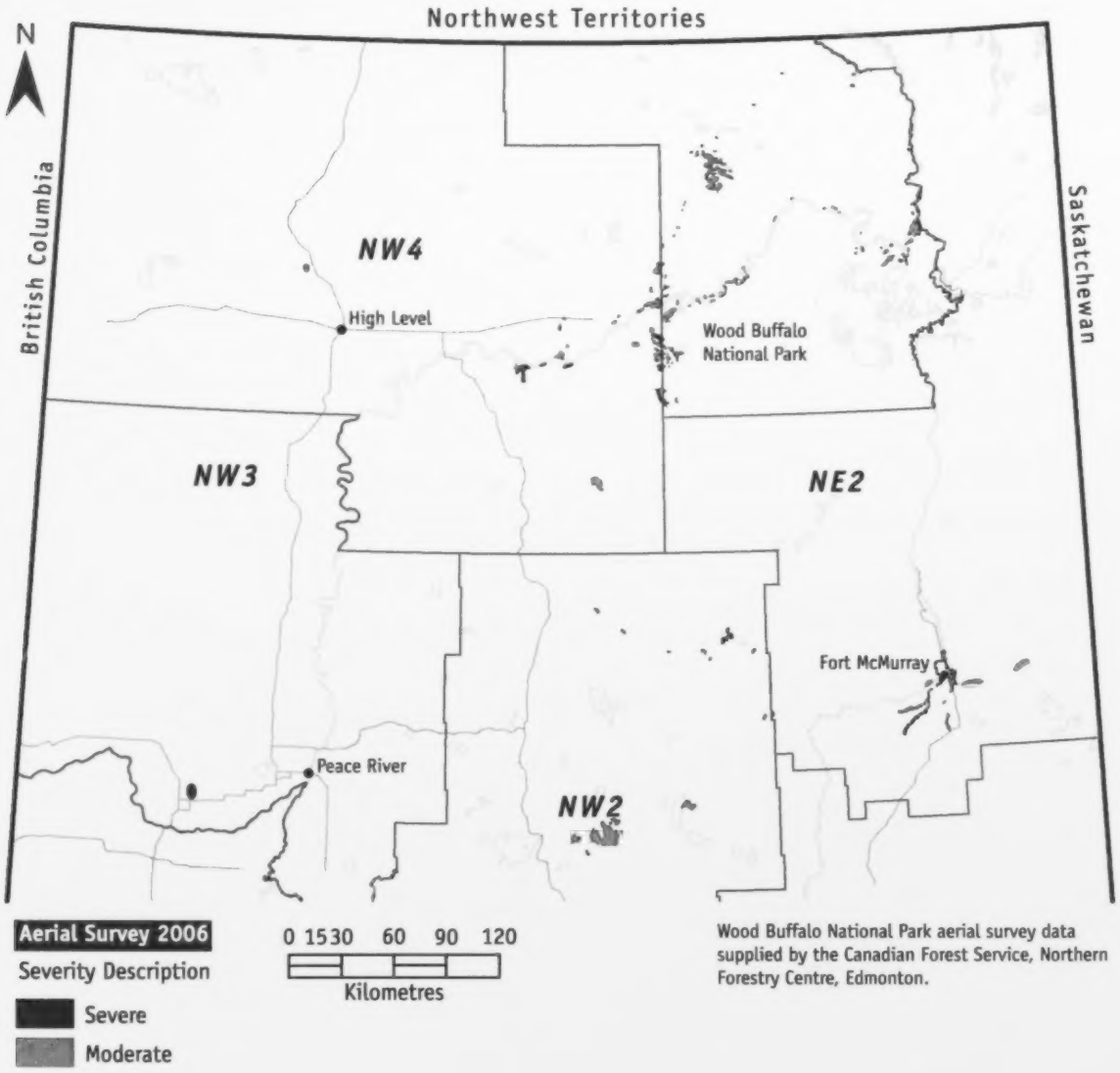


Figure 2
Spatial distribution of aerially visible spruce budworm defoliation on forested land surveyed in Alberta in 2006.

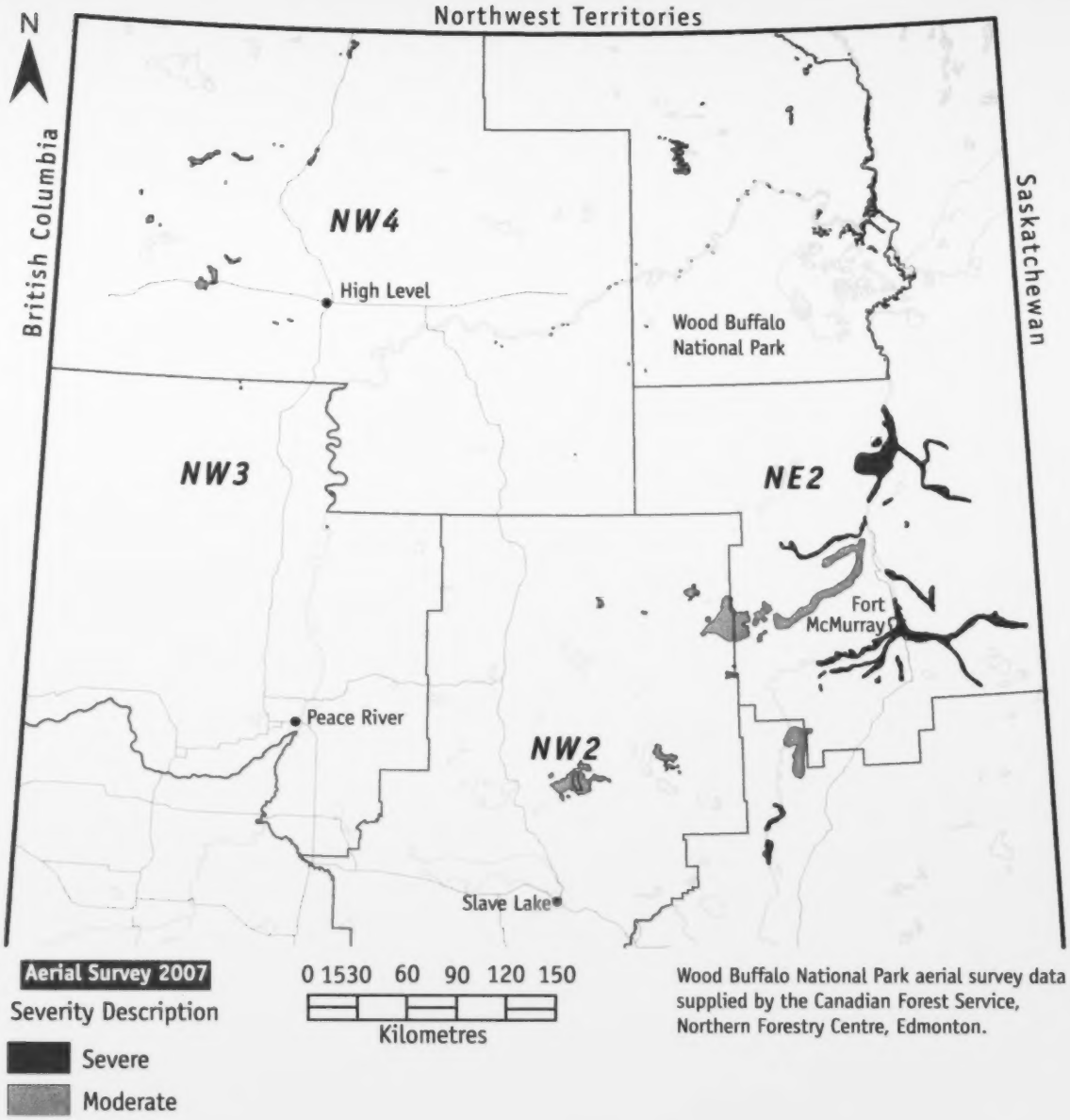


Figure 3
Spatial distribution of aerially visible spruce budworm defoliation on forested land surveyed in Alberta in 2007.

The severity of spruce budworm defoliation also increased in 2007 compared to that observed in 2006. Between 2006 and 2007 the severely defoliated area increased from 7121 hectares to 53,636 hectares (653%) and the moderately defoliated area increased from 29,650 hectares to 55,122 hectares (85%) (Table 1)

Table 1
The number of hectares of spruce budworm defoliation by severity categories in Alberta,[1] 2006 vs. 2007.

	2006			2007		
	Moderate	**Severe**	**Total**	**Moderate**	**Severe**	**Total**
Net	17,282	3901	21,183	36,607	35,688	72,295
Gross[2]	12,368	3220	15,588	18,515	17,948	36,463
Total	29,650	7121	36,771	55,122	53,636	108,758
Increase[3]	-	-	-	85%	653%	196%

1 Excluding defoliated area in Wood Buffalo National Park

2 Defoliated area in non-inventoried forest land

3 Percent increase in defoliated area compared to the corresponding figure in 2006

The details of spruce budworm defoliation in northern Alberta are given below.

Northeast Alberta

Martin Robillard (Forest Health Technician) and a contractor carried out aerial surveys of spruce budworm defoliation in Lac La Biche and Waterways areas on July 11-12, 2007. This survey was carried out mostly under sunny weather with some scattered clouds by using fixed wing aircraft (either Cessna 206 or Cessna 172). The surveyors flew for 10 hours at 500 to 800 metre altitude depending on the terrain and visibility. They followed a pre-determined flight path along major river drainages. The path was determined based on distribution of susceptible host stands, terrain and 2006 defoliation. Some transects were flown to cover relatively large host stands. The extent and severity (moderate vs. severe) of defoliation were recorded digitally by using a tablet personal computer (HP TC4200) linked to a global positioning system (Bluetooth GlobalSat). In addition, defoliation was recorded on hard copies of 1:250,000 scale maps (National Topographic Series). The information from both of these sources was combined to produce a final map illustrating the extent and severity of defoliation in 2007.

The results of this survey are shown in Figure 3. The surveyors observed a significant increase in the extent and severity of defoliation compared to those observed in 2006. There was extensive and severe defoliation along many river drainages located west of the Fourth Meridian in the Waterways Area. Two patches of severe defoliation along the Athabasca River in Townships 75-78 and Ranges 17-18 extended as far south as McMillan Lake. A large patch of defoliation was noted along the House River from its confluence with the Athabasca River to Township 80 and Range 16. Severe defoliation occurred south of Fort McMurray approximately to Township 86 along the Horse and Hangingstone rivers, and to Range 14 along the Athabasca River. Severe defoliation was observed along the Clearwater River to Township 85 and Range 4 and almost up to the Saskatchewan border. Severe defoliation was recorded along the length of Steepbank, McKay, Dover, Margeurite and Ells rivers. Along the Athabasca River there was severe defoliation from north of Fort McMurray to Township 91 and in Townships 97 to 103 especially northwest of McClelland Lake. There was severe defoliation in Range 4 along the Firebag River. Smaller patches of severe defoliation were found south of McClelland Lake and on the southwest corner of Kearle Lake.

Table 2
The number of hectares of spruce budworm defoliation by severity categories in northeast Alberta, 2006 vs. 2007.

Area	Year of Defoliation					
	2006			2007		
	Moderate	Severe	Total	Moderate	Severe	Total
Lac La Biche	0	0	0	6037	4447	10,484
Waterways						
Net	3974	1042	5016	7643	31,241	38,884
Gross	0	0	0	17,776	17,948	35,724
Total	3974	1042	5016	31,456	53,636	85,092

The aerial survey observations in northeast Alberta were verified during spruce budworm male moth ground surveys carried out in the summer.

Table 2 shows the extent and severity of spruce budworm defoliation in Lac La Biche and Waterways areas in 2007 compared to the corresponding figures in 2006. In 2007, spruce budworm defoliated a net area of 10,484 hectares in the Lac La Biche Area compared to no defoliation observed in 2006. Defoliation was moderate in 58% and severe in 42% of the area. In the Waterways Area 38,884 hectares in inventoried forest were defoliated. Defoliation was moderate over 20% and severe over 80% of this area. An additional 35,724 hectares in the non-inventoried forest were defoliated by the spruce budworm. Nearly 50% of this defoliation was moderate and the other 50% was severe.

Spruce budworm damage

Overall, spruce budworm defoliation in the northeast increased by about 16-fold from 2006 to 2007. This increase reversed a declining trend of defoliation observed in the northeast in the preceding few years (Figure 4).

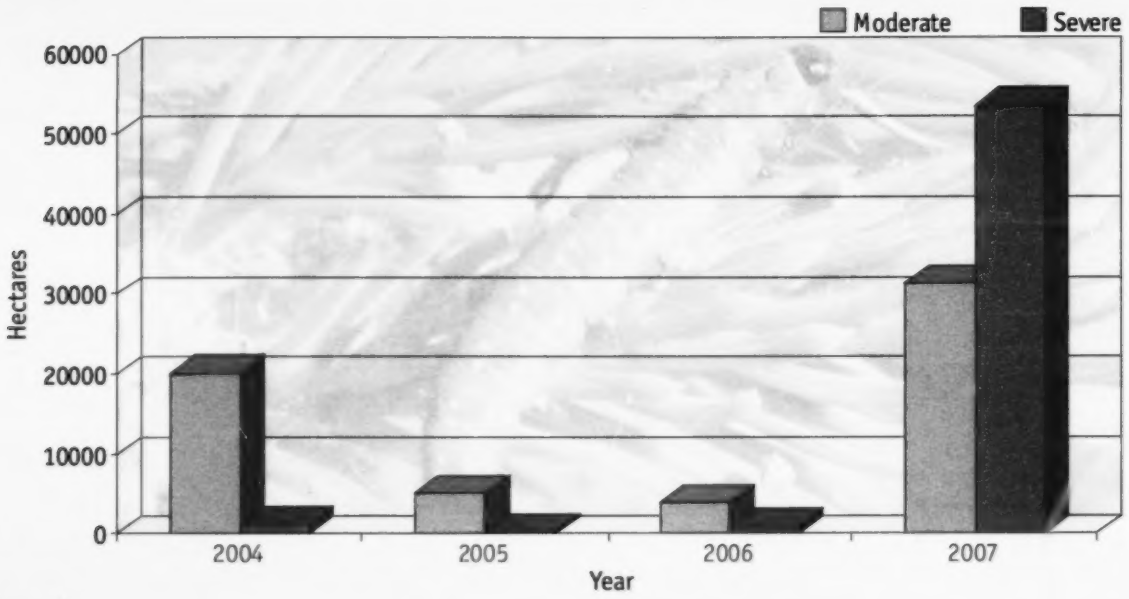


Figure 4
Number of spruce budworm–defoliated hectares by severity categories in northeast Alberta, 2004 – 2007.

Northwest Alberta

On July 12th and 13th, Mike Maximchuk (Forest Health Officer) carried out aerial surveys of spruce budworm defoliation in the Peace and Upper Hay areas. He used a fixed wing aircraft (Cessna 210) for this survey. Mike flew between 1500 to 2500 feet (457 to 762 metres) above the mean sea level under sunny conditions; visibility was clear on July 12th but smoke made visibility poor on July 13th. During these surveys he flew for 15 hours along a pre-determined path interspersed with flying either in a grid or a zig-zag pattern where needed. His observations were digitally recorded either as moderate or as severe defoliation by using a tablet personal computer (HP TC4200) linked to a global positioning system (GlobalSat BT359 Bluetooth).

Mike Maximchuk, Dale Thomas (Forest Health Officers) and Jesse Baron (Forest Health technician) carried out aerial surveys of spruce budworm defoliation in the Lesser Slave Area on July 18 and August 3, 2007. They flew in a fixed wing aircraft (Cessna 210) under sunny but partly cloudy conditions for 6.2 hours. They recorded data digitally by using a tablet personal computer (HP TC4200) linked to a global positioning system (GlobalSat BT359 Bluetooth). Figure 3 shows the results of these surveys.

In the Peace and Upper Hay areas spruce budworm defoliation was found over 9473 hectares. This defoliation was moderate in severity. In the Peace Area defoliation was detected over a net area of 332 hectares and over a gross area of 130 hectares. In this Area defoliation was restricted to a few patches along the Peace and Chinchaga rivers. In 2006 there was no aerially visible spruce budworm defoliation in

this Area. In the Upper Hay Area defoliation was found over 9011 hectares; the net and gross areas of defoliation were 8901 and 110 hectares respectively (Table 3). Patches of defoliation were detected along the Chinchaga, Amber and Hay rivers and in the upper reaches of Steen River; in addition, patches of defoliation were observed along the Negus Creek, north of Zama City, near Adair Fire Lookout. This pattern of defoliation is reminiscent of the early stages of the last spruce budworm infestation in the 1990's when most of these areas were defoliated. Since 2003 no spruce budworm defoliation has been observed in these areas until now. Many patches of defoliation observed in the eastern part of the Upper Hay Area in 2006 disappeared in 2007 (Figures 2 and 3). Instead defoliation was observed along the Wabasca, Peace and Mikkwa rivers and along the western border of Wood Buffalo National Park (Figure 3).

In the Lesser Slave Area, spruce budworm defoliated 13,964 net hectares in inventoried forest and 499 gross hectares in non-inventoried forest. Defoliation was of moderate severity. This defoliation included a relatively large block near Britnell Lake located about 60 km north of Slave Lake. This defoliated area has expanded in comparison to that in 2006. The patch of defoliation found north of Wabasca Lake almost doubled in size from 2006 to 2007. Three other smaller patches of defoliation were detected along Chipewyan Lake, Buffalo Lake and about 25 km north of Trout Mountain.

Table 3

The number of hectares of spruce budworm defoliation by severity categories in northwest Alberta, 2006 vs. 2007.

Area	Year of Defoliation					
	2006			2007		
	Moderate	Severe	Total	Moderate	Severe	Total
Lesser Slave						
Gross	0	0	0	499	0	499
Net	7248	576	7824	13,694	0	13,964
Peace						
Gross	0	0	0	130	0	130
Net	0	0	0	332	0	332
Upper Hay						
Gross	0	0	0	110	0	110
Net	6060	2283	8343	8901	0	8901
Total						
Gross	0	0	0	739	0	739
Net	13,308	2859	16,167	22,927	0	22,927

In northwest Alberta spruce budworm defoliation began to increase in 2006 and this trend continued in 2007 (Figure 5). The last spruce budworm outbreak in this area began 20 years ago and most of the new defoliation in 2007 has occurred in the same areas that were defoliated at the beginning of the previous outbreak in late 1980s. The development of this outbreak will be monitored so that early action to manage this infestation can be taken when necessary.

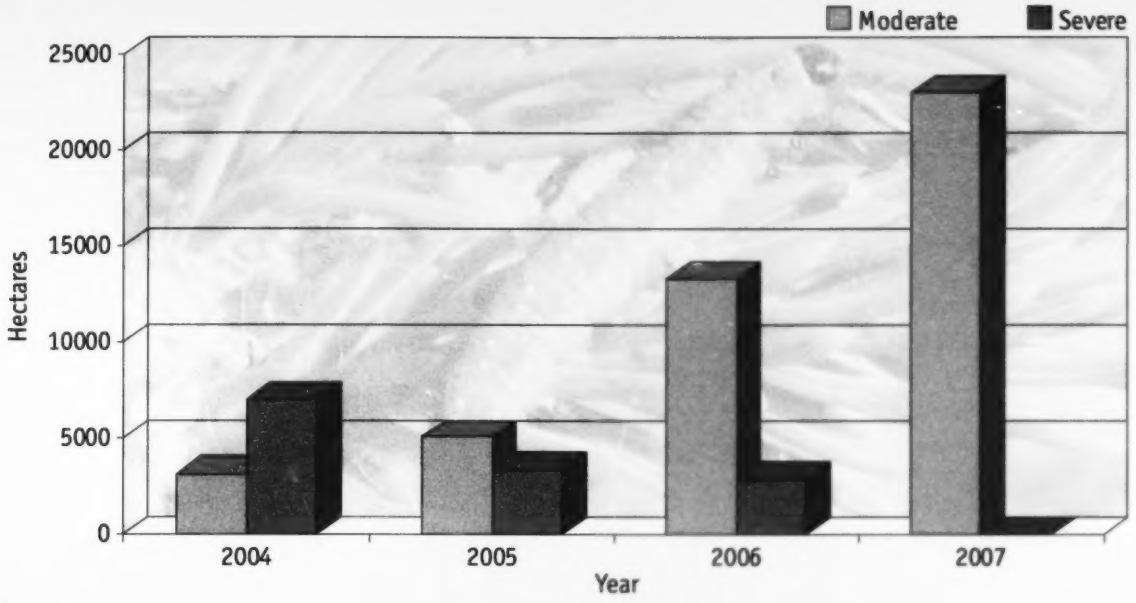


Figure 5
Number of spruce budworm–defoliated hectares by severity categories in northwest Alberta, 2004 – 2007.

National Parks

Wood Buffalo National Park

On July 19, 2007, Roger Brett, the Supervising Forest Health Technician at the Northern Forestry Centre, Canadian Forest Service carried out an aerial survey over Wood Buffalo National Park. He flew under sunny conditions with clear visibility in the north and wildfire smoke with scattered showers that provided limited visibility in the south of this park. The results of this survey are shown in Figure 3.

Spruce budworm defoliation was detected over an estimated 34,086 hectares of this park. This was a slight increase compared to the 33,591 hectares defoliated in 2006. Most of the defoliation was moderate. Spruce budworm defoliation was located along the Athabasca and Peace rivers, and in Pine Lake and Merryweather Lake areas. New pockets of defoliation were observed west (534 hectares) and south (749 hectares) of Fort Chipewyan. The defoliation along the Peace River and the southwest border of the park was reduced from 6416 hectares in 2006 to 229 hectares in 2007. Infestation near Merryweather Lake covered an estimated 10,406 hectares. Tree kill and top kill were found in some areas defoliated for several consecutive years by the spruce budworm. These include Salt Mountain, Merryweather Lake and areas along the Peace and Athabasca rivers. As well, some top kill and tree kill were observed in the Pine Lake area.

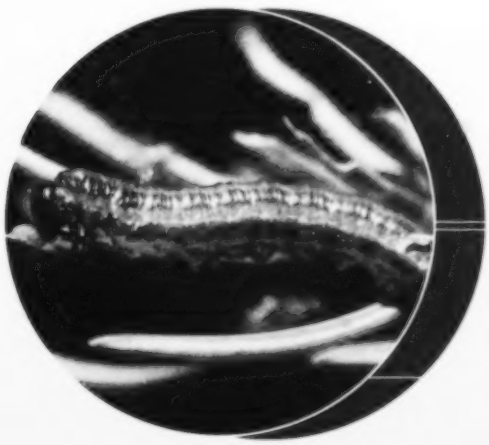
Provincial Parks

Cypress Hills Inter-Provincial Park

The spruce budworm defoliation that occurred in this park over the last few years worsened in 2007. Severe spruce budworm defoliation was observed in most of the spruce stands in the park in 2007. This defoliation had not been surveyed since it began a few years back (Les Weekes, 2007).

Yellowheaded Spruce Sawfly
Pikonema alaskensis (Rohwer)

Yellowheaded spruce sawfly (YHSS) infestations occurred at a few locations in northeast Alberta. The YHSS populations declined in white spruce plantations located on reclaimed oil sands lands in Fort McMurray. In 2007, no aerial spraying was carried out to control the YHSS in these lands. This pest continued to be a concern in white spruce plantations growing on reclaimed lands in Canadian Natural Resources and Imperial Oil properties. No YHSS infestations were reported from Cypress Hills Interprovincial Park in 2007. However, YHSS was a serious problem in Edmonton's urban forest in 2007 (see under Urban Pests).



Douglas Fir Pests

Western Spruce Budworm
Choristoneura occidentalis (Freeman)

The first major outbreak of the western spruce budworm in the province has been ongoing for several years in the Porcupine Hills area of the Southern Rockies Area. Judging by the current level of tree kill and top kill of the affected trees this infestation may have started about five years ago.

On June 27 and September 13, Rupert Hewison, Forest Health Technician in the Southern Rockies Area, carried out aerial surveys of this infestation. He used a fixed-wing (Cessna) as well as a rotary-wing (A-Star 83) aircraft for these surveys. The surveys were carried out for four hours under clear skies with good visibility. The results were recorded digitally by using a tablet personal computer (HP TC4200) linked to a global positioning system (GlobeSat BT359 Bluetooth). The results were ground-truthed during an egg mass survey carried out in the fall.

The results of these surveys are shown in Figure 6. The defoliation covered an estimated 17,679 hectares. Defoliation was light over 1403 hectares located north of Highway 2 in the C5 Management Unit near the Municipality of Crowsnest Pass, north of Coleman and in Whaleback area. Defoliation was moderate over 75 hectares and severe over 16,201 hectares in Porcupine Hills.

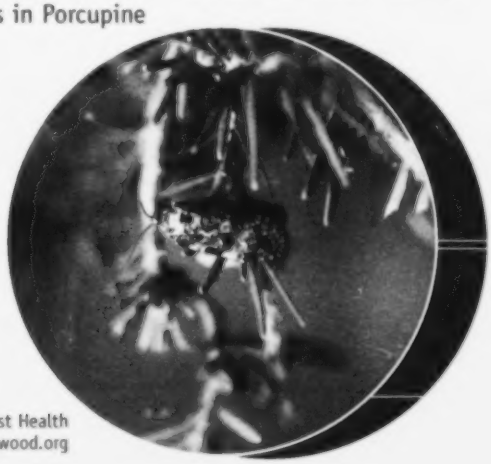


Photo Credit: Milliam M. Ciesla, Forest Health Management Internatioinal, Bugwood.org

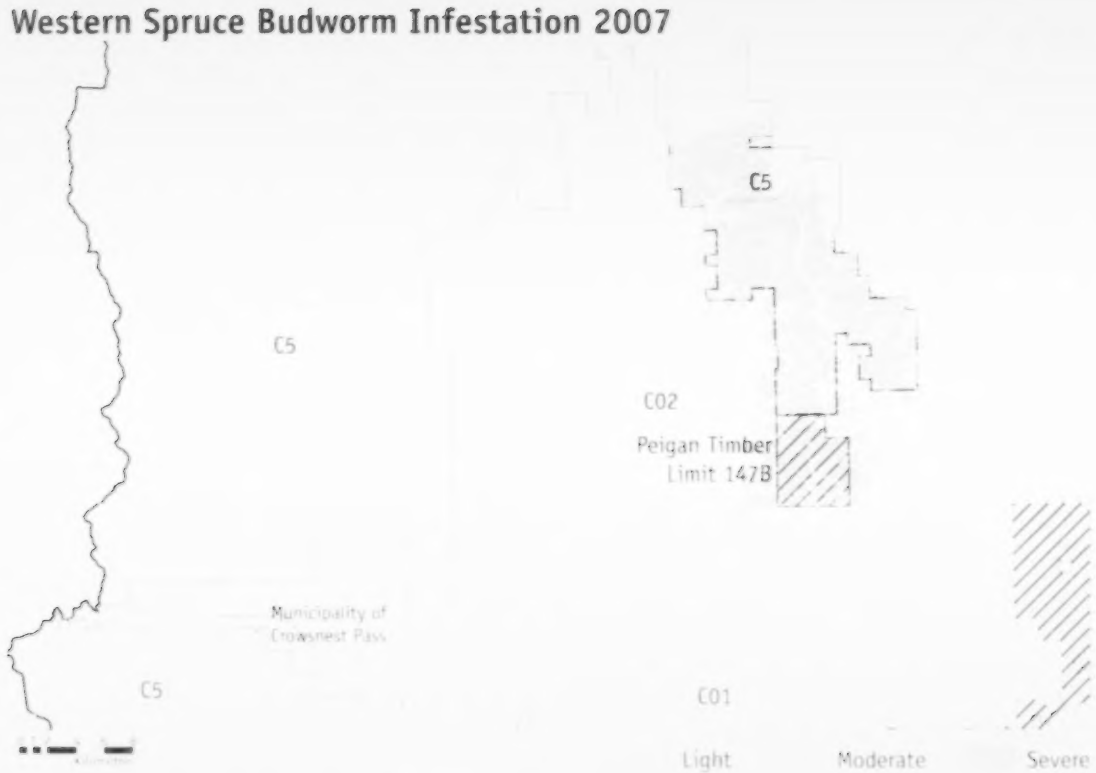


Figure 6
Spatial distribution of aerially visible western spruce budworm defoliation on forested land surveyed in Porcupine Hills of southern Alberta, 2007.

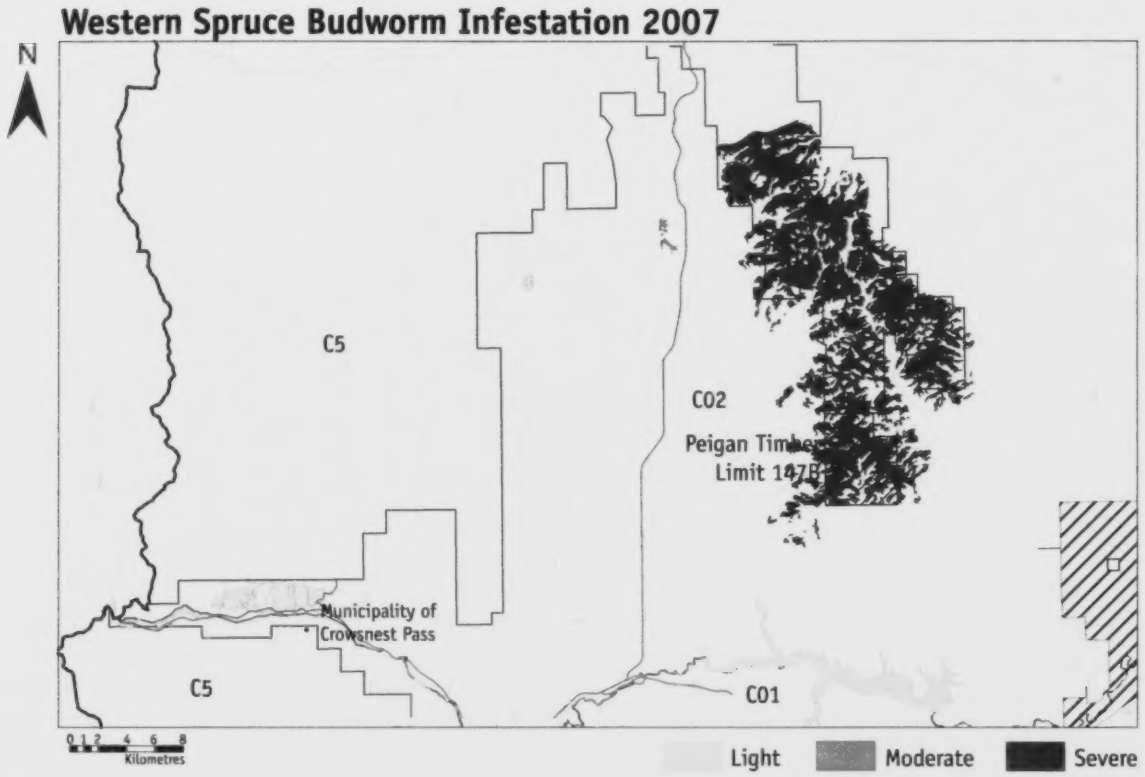


Figure 6
Spatial distribution of aerially visible western spruce budworm defoliation on forested land surveyed in Porcupine Hills of southern Alberta, 2007.

Pine Pests

Mountain Pine Beetle

Dendroctonus ponderosae (Hopkins)

The current mountain pine beetle (MPB) outbreak was detected in the forested Crown land in 2000/01 beetle year. Since then the number of mountain pine beetle-infested trees detected in Alberta has increased exponentially (Figure 7).

The exponential increase in the number of beetle-infested trees occurred following a massive flight of MPB from British Columbia in July 2006 that scattered beetles over a wide area in northern Alberta. These areas in northern Alberta could not be surveyed from the air until the resulting faders became visible from the air. To determine the extent of this infestation a telephone hotline was established in 2006 for the general public, workers of the forest industry and the oil and gas sector to report infested trees. Reports of infested trees on Crown land were followed up by local Forest Health staff and reports of infested trees on private land were forwarded to the respective municipality. SRD also conducted preliminary walk through detection surveys in highly susceptible stands to identify areas with MPB presence.

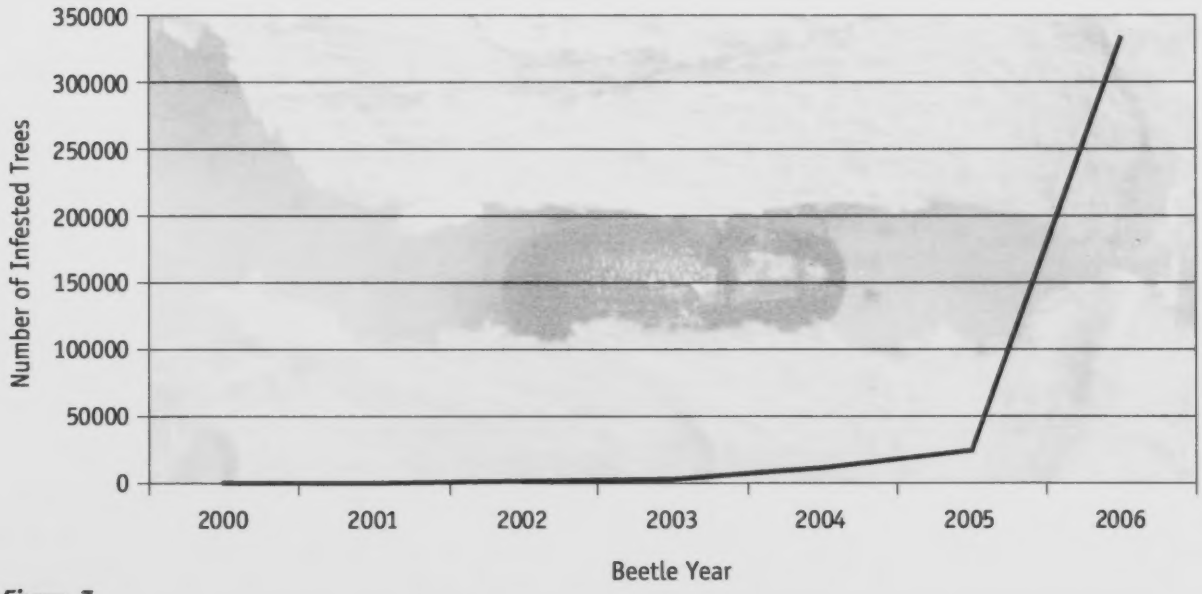


Figure 7

Number[2] of suspected mountain pine beetle infested trees detected in Alberta during the current outbreak.

[2] The line graph shows the number of green attacks detected in the current year plus the number of fresh faders detected in the surveyed areas in the following year. Not all forested areas were surveyed and not all trees with red foliage were necessarily killed by the MPB.

In the fall of 2006, the Forest Health Officers carried out heli-GPS survey programs to detect faders in areas where MPBs were present the previous year and faders were observable from the air (see Figure 8). Ground surveys were then carried out to detect green attack trees which were subsequently controlled. In some areas Summer Early Detection Overview Surveys (SEDOS) were conducted in June 2007 to detect early faders. Baits were deployed where infested trees could not be controlled in time before the beetle flight in 2007.

The results of 2006 fall heli-GPS surveys are shown in Figure 8. The full extent of the infestation in 2006 can be better seen in Figure 9 showing the results of the 2007 fall heli-GPS surveys. These 2007 fall heli-GPS survey results showed an unprecedented dispersal of MPB into northwest Alberta (Figure 9). This figure also illustrates the potential of MPB to spread hundreds of kilometres into new territory during these massive flights.

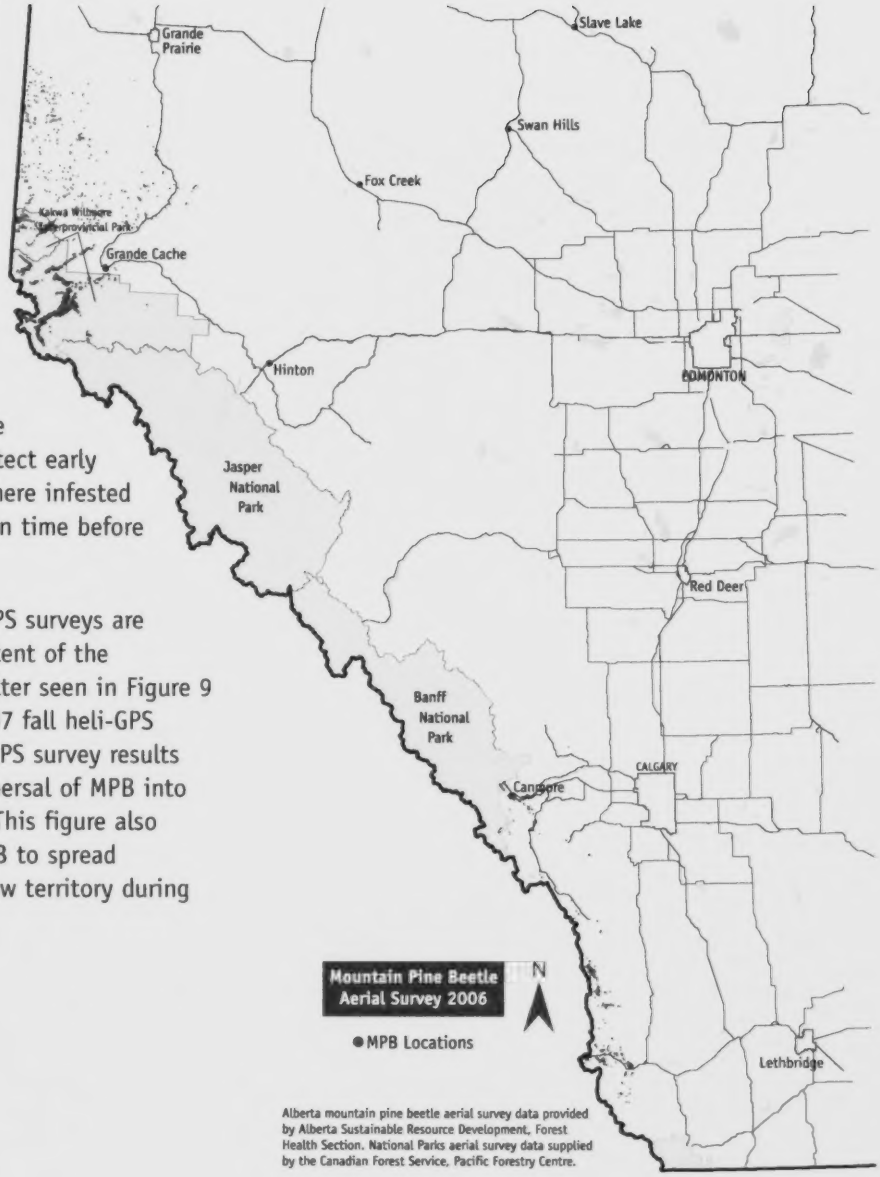


Figure 8
Results of the 2006 fall heli-GPS survey showing distribution of faders resulted from the 2005 beetle flights in Alberta.

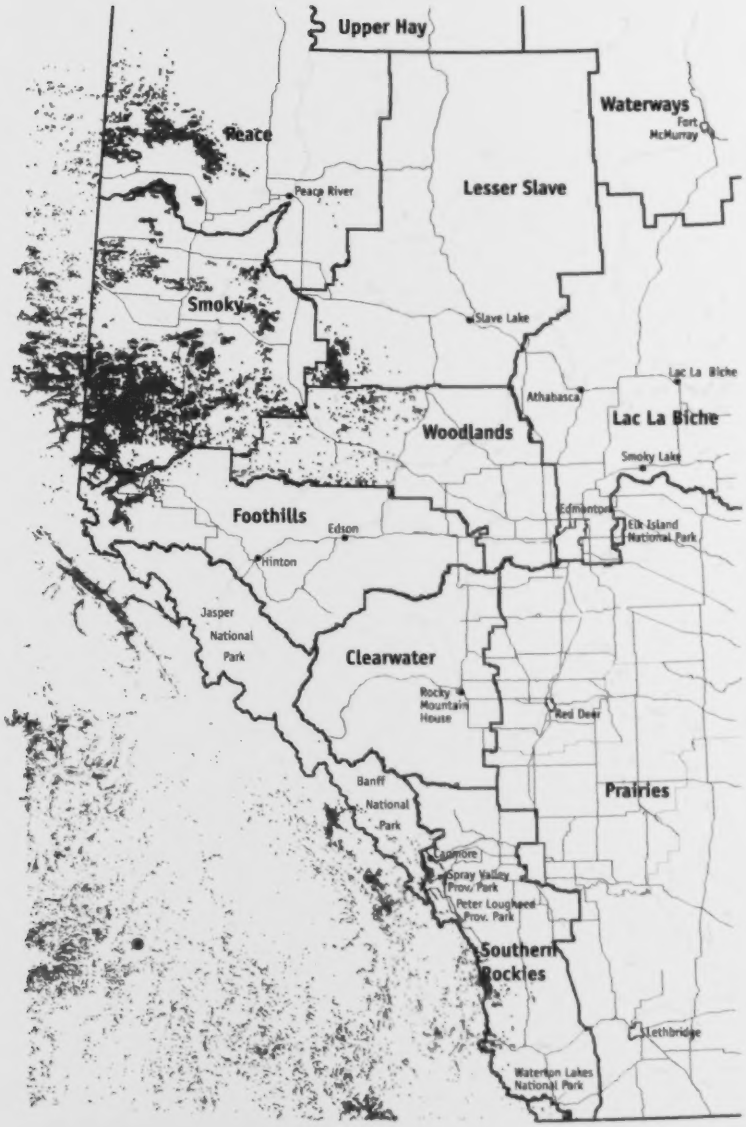


Figure 9

Results of the fall 2007 mountain pine beetle heli-GPS surveys showing distribution of faders resulted from the massive influx of beetles into Alberta in July 2006.

Aspen Pests

Forest Tent Caterpillar
Malacosoma disstria (Hübner)

Annual aerial overview surveys were carried out to estimate the extent and severity of insect pest-caused aspen defoliation. The surveyors used fixed-wing aircraft. They recorded survey data either digitally by using a tablet personal computer linked to a global positioning system or manually on hard copies of 1:250,000 scale maps. The defoliation was categorized as light (less than 35%), moderate (35-70%) or severe (over 70%).

Aspen defoliation in forested Crown land of the province in 2007 was solely attributed to the predominant defoliator, the forest tent caterpillar. However, the linden looper (*Erannis tillaria* (Harris), Bruce spanworm (*Operophtera bruceata* (Hulst) and fall cankerworm (*Alsophila pometaria* (Harris) also defoliated aspen. Aspen defoliation was scattered over an estimated gross area of 3,255,338 hectares. This is a significant (44.4%) decline compared to the 5,851,155 hectares with defoliation in 2006 (Figures 10 and 11). Aspen defoliation was severe over 1,562,582 hectares (48%), moderate over 1,049,878 hectares (32%) and light over 642,878 hectares (20%) (Table 4). The pattern of aspen defoliation in Alberta from 2004-2007 is illustrated in Figure 12. It shows that increasing trend of aspen defoliation observed in the province from 2004 to 2006 ended in 2007.

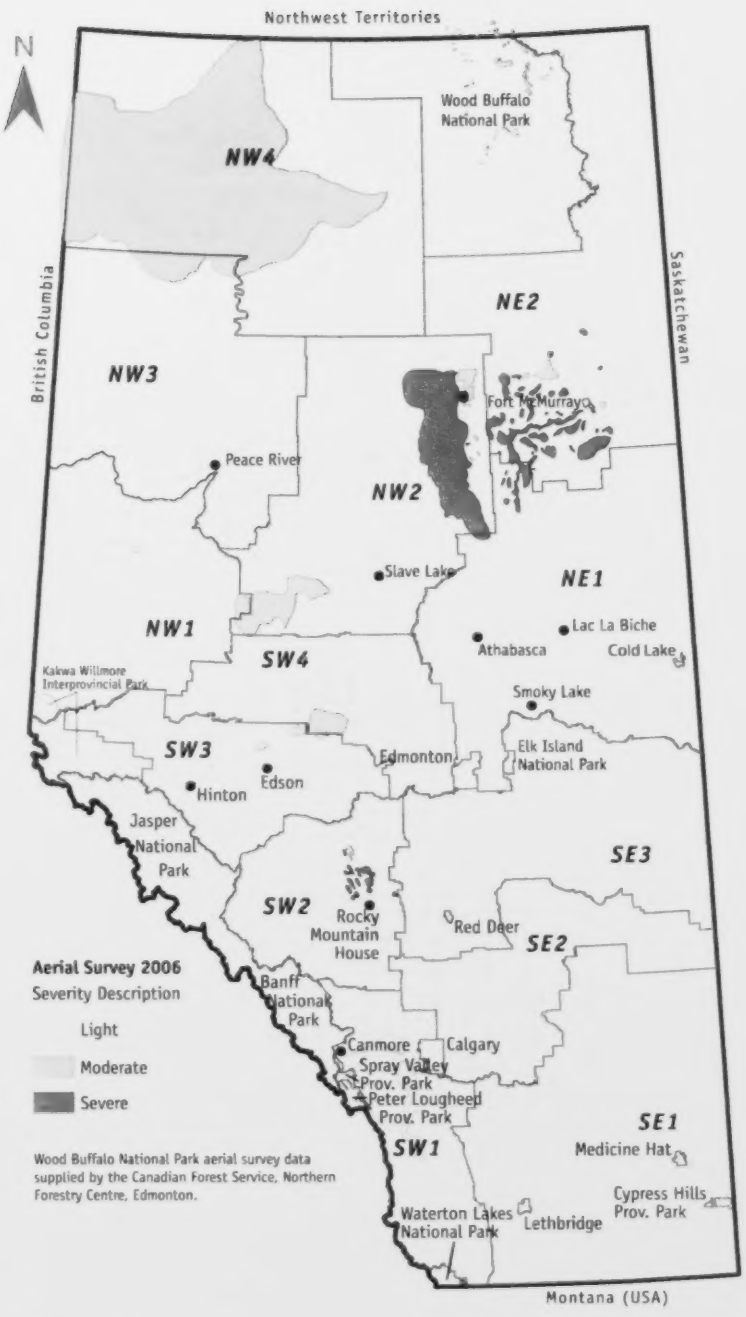


Figure 10
Spatial distribution of aerially visible insect-caused aspen defoliation on forested areas surveyed in Alberta, 2006.

Figure 11
Spatial distribution of aerially visible insect-caused aspen defoliation on forested areas surveyed in Alberta, 2007.

Aspen Pests

Forest Tent Caterpillar
Malacosoma disstria (Hübner)

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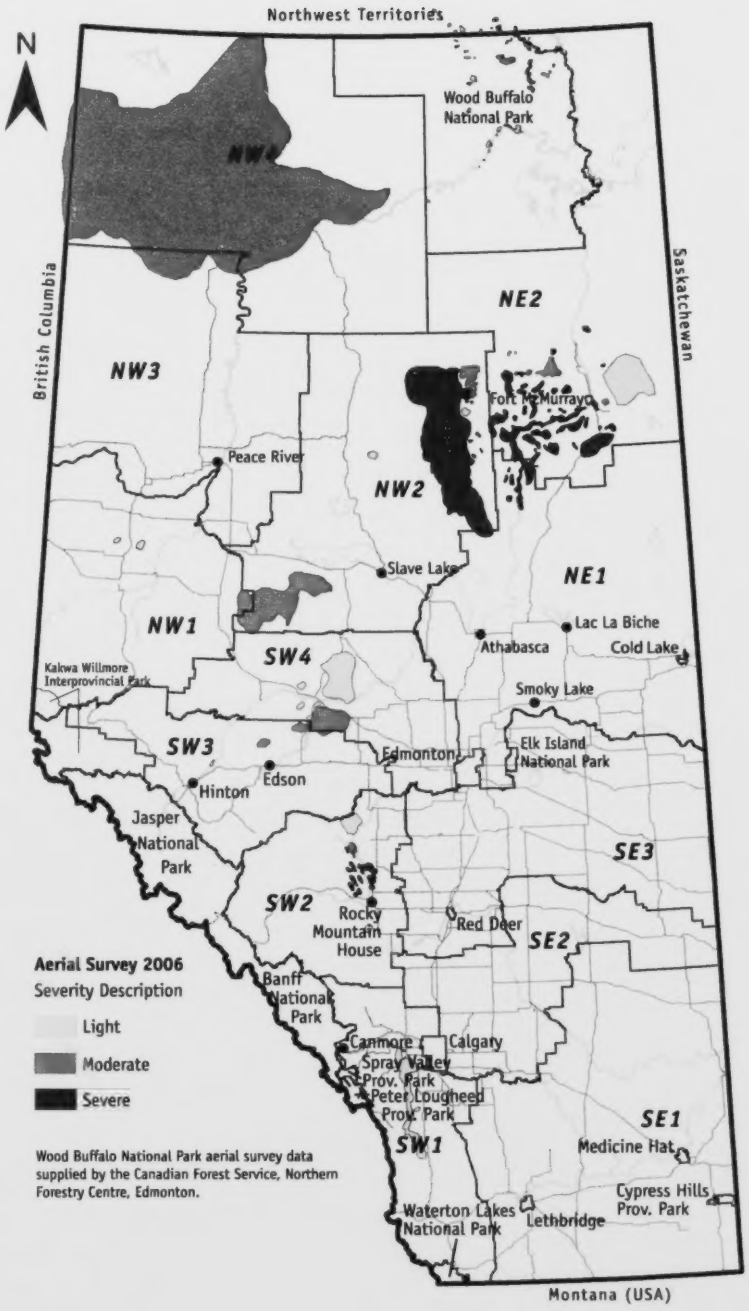


Figure 10
Spatial distribution of aerially visible insect-caused aspen defoliation on forested areas surveyed in Alberta, 2006.

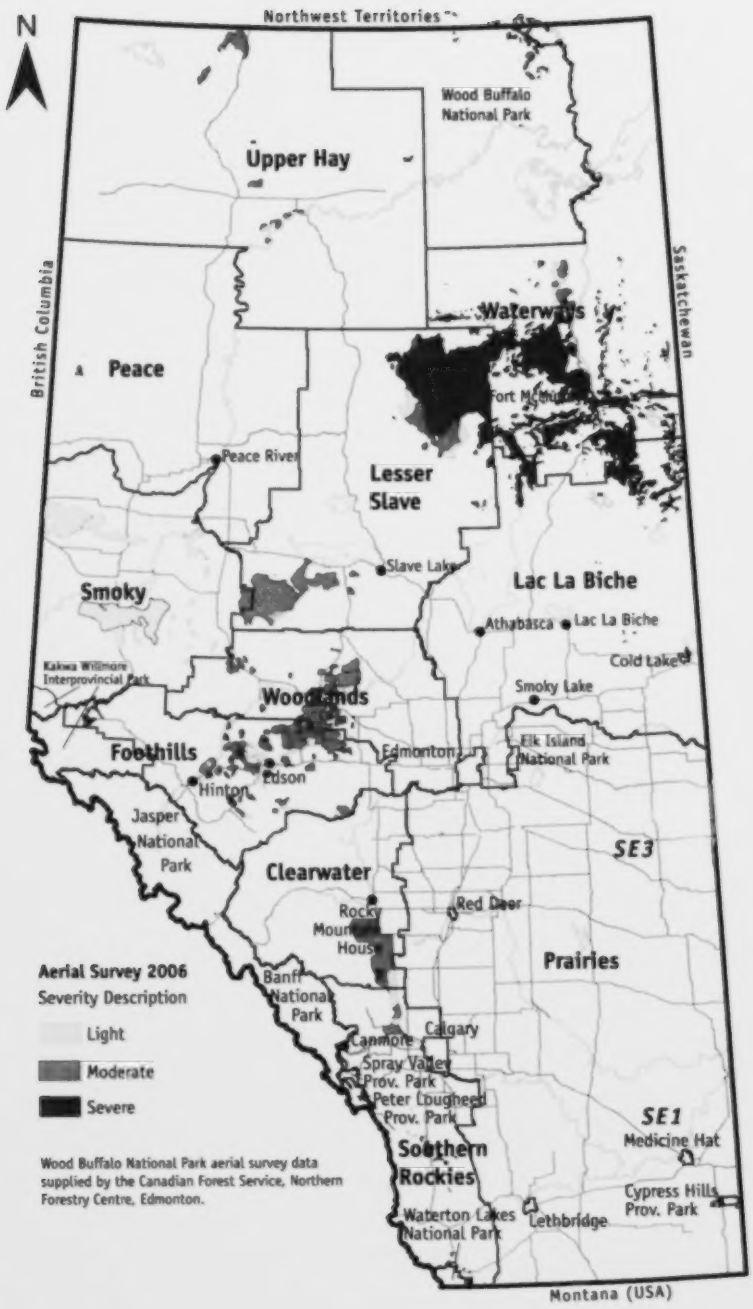


Figure 11
Spatial distribution of aerially visible insect-caused aspen defoliation on forested areas surveyed in Alberta, 2007.

Table 4
The extent of forest insect caused aspen defoliation by severity categories in Alberta, 2006 vs. 2007.

Location	Gross area of defoliation (ha)					
	2006			2007		
	Light	Moderate	Severe	Light	Moderate	Severe
Northeast	161,508	28,859	279,555	46,164	49,620	895,236
Northwest	18,027	4,329,260	631,992	457,610	408,379	628,741
Southwest	258,924	108,943	34,088	98,296	411,823	35,185
Subtotal	438,459	4,467,062	945,635	642,878	1,049,878	1,562,582
Grand Total		**5,851,155**			**3,255,338**	

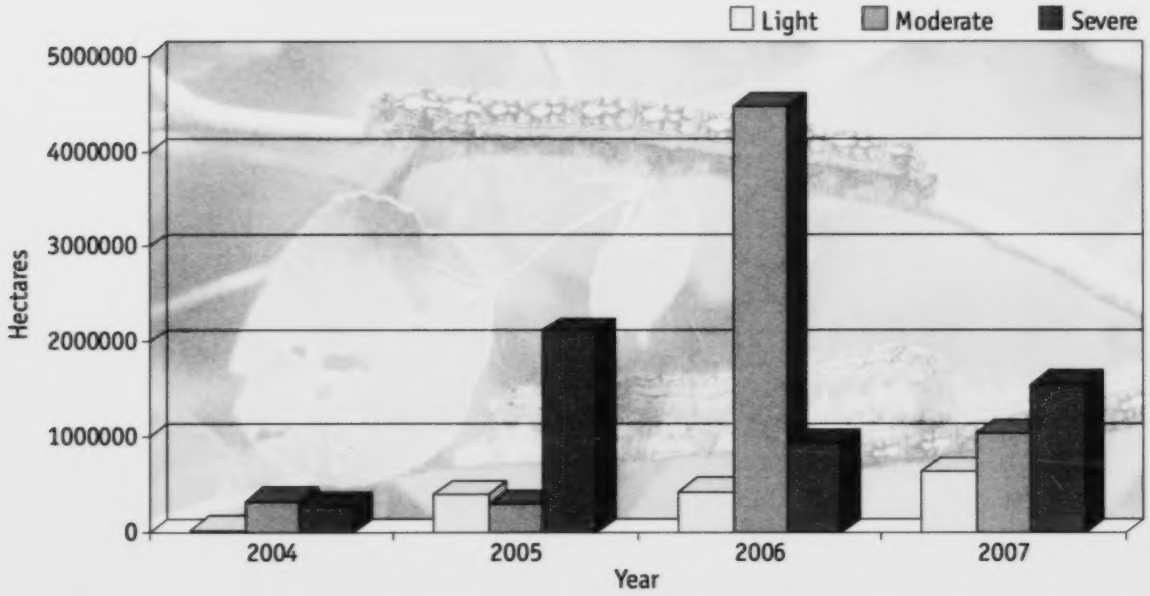
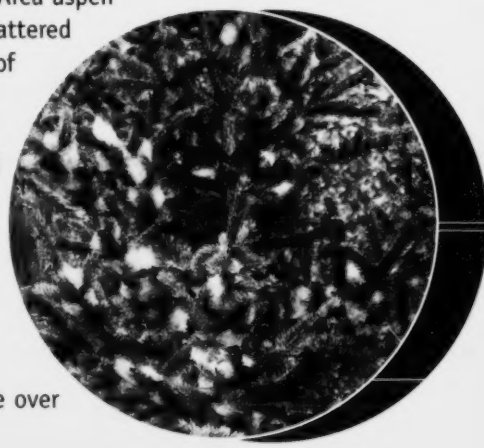


Figure 12
The gross number of hectares with aspen defoliation by severity categories in Alberta, 2004 – 2007.

Northeast Alberta (Lac La Biche and Waterways Areas)

Tom Hutchison (Forest Health Officer), Martin Robillard (Forest Health Technician) and a contractor carried out aerial surveys to record aspen defoliation over northeast Alberta. They flew in a fixed-wing aircraft (Cessna 206) under overcast conditions on July 9th and under sunny conditions with scattered clouds on July 10 and 13. The aspen defoliation was recorded either digitally by using a tablet personal computer (HP tc4200) linked to a global positioning system (Bluetooth GlobalSat) or manually on hard copies of 1:250,000 maps (National Topographic Series). They flew at an altitude of 500 to 800 metres for a combined total of 20 hours. During these flights the entire Green Zone and part of the White Zone within these areas were covered in a grid pattern at 15-20 km intervals. The results of these surveys are shown in Figure 11.

(*Choristoneura conflictana* (Walker) was found near Cold Lake, Wolf Lake and Borque Lake. Linden looper defoliation was visible near Margaerite Lake and Wolf Lake. The Bruce spanworm and aspen leafroller (*Pseudexentera oregonana* (Walker) defoliated aspen around Long Lake Provincial Park.



In the Waterways Area aspen defoliation was scattered over a gross area of 774,244 hectares. This was a 68% increase compared to 469,922 hectares defoliated in 2006. Defoliation was severe over 695,234 hectares (89.8%), moderate over

Table 5
The extent of insect pest caused aspen defoliation by severity categories in northeast Alberta, 2006 vs. 2007.

Corporate Area	Gross area of defoliation (ha)					
	2006			2007		
	Light	Moderate	Severe	Light	Moderate	Severe
Lac La Biche	0	913	46,549	14,925	1849	200,002
Waterways	161,508	27,946	233,066	31,239	47,771	695,234
Subtotal	161,508	28,859	279,615	46,164	49,620	895,236
Grand Total		**469,922**			**991,020**	

In the Lac La Biche Area the forest tent caterpillar defoliation was scattered over a gross area of 216,776 hectares. This was a 356% increase compared to the 47,462 hectares defoliated in 2006. Defoliation was severe over 200,002 hectares (92.3%), moderate over 1849 hectares (less than 1%) and light over 14,925 hectares (6.9%) (Table 5). Light defoliation attributed to the large aspen tortrix 47,771 hectares (6.2%) and light over 31,239 hectares (4.0%) (Table 5). Moderate defoliation was found east of the Athabasca River as far north as Township 103. Severe defoliation was found in most of the areas including Township 79 along the Athabasca River in the south 79; Township 77 north of Winefred Lake; and from the Saskatchewan border to west edge of the Area between Townships 78 and 97.

Northwest Alberta (Smoky, Lesser Slave, Peace and Upper Hay Areas)

The insect-caused aspen defoliation in 2007 in the Northwest was attributed to the forest tent caterpillar. This defoliation was scattered over an estimated 1,494,730 hectares. As predicted in 2006, aspen defoliation in northwest Alberta declined in 2007. There was a 70% reduction of the area with defoliation compared to that in 2006. The severity of defoliation also decreased (Table 6, Figures 10 and 11). The current cycle of insect-caused aspen defoliation in northwest Alberta appears to be declining after reaching a peak in 2006. Table 6 shows aspen defoliation in different Areas in northwest Alberta in 2006 vs. 2007.

Smoky Area

The results of the aerial overview survey on insect pest-caused aspen defoliation are shown in Figure 11. This defoliation, caused by the forest tent caterpillar, was scattered over a gross area of 427,240 hectares. This was almost an 11-fold increase in the defoliated area compared to 36,480 hectares defoliated in 2006. Defoliation was light over 401,003 hectares (93.9%), moderate over 23,934 hectares (5.6%) and severe over 2303 hectares (0.5%) (Table 6). The aspen leaf roller that defoliated aspen stands in the Smoky Area in 2006 did not recur in 2007.

Lesser Slave Area

Dale Thomas (Forest Health Officer) carried out an aerial overview survey of aspen defoliation in early June. Although he detected both forest tent caterpillar and Bruce spanworm in the surveyed area (Figure 11), the observed defoliation was attributed to the forest tent caterpillar, the predominant defoliator. Aspen defoliation was scattered over an estimated gross area of 996,373 hectares. This was a 10% increase compared to the 903,297 hectares defoliated in 2006. This may indicate slowing down of the spread of this infestation. Defoliation was severe over 626,439 hectares (62.9%), moderate over 313,882 hectares (31.5%) and light over 56,052 hectares (5.6%). The forest tent caterpillar defoliation was mainly found in the northeast corner of the Area in Townships 83-96 in Range 20 west of the 4th Meridian to Range 4 west of Fifth Meridian. The Bruce spanworm defoliation was observed in the southwest corner of the Area in Townships 68-73 in Range 8-9 west of the 5th Meridian.

Table 6

The extent of insect pest caused aspen defoliation by severity categories in northwest Alberta, 2006 vs. 2007.

Corporate Area	**Gross area of defoliation (ha)**					
	2006			**2007**		
	Light	**Moderate**	**Severe**	**Light**	**Moderate**	**Severe**
Smoky	7757	28,723	0	401,003	23,934	2303
Lesser Slave	10,271	261,034	631,992	56,052	313,882	626,439
Peace	0	189,950	0	555	3773	0
Upper Hay	0	3,849,553	0	0	66,790	0
Subtotal	18,027	4,329,260	631,992	457,610	408,379	628,741
Grand Total		**4,979,279**			**1,494,730**	

Peace and Upper Hay Areas

Mike Maximchuk (Forest Health Officer) and Natalie Henneberry (Forest Health Technician) carried out aerial overview surveys of aspen defoliation on July 5, 13 and 23. They used a fixed-wing aircraft and digitally recorded their observations by using a tablet personal computer linked to a global positioning system. Figure 11 shows the results of these surveys. Aspen defoliation in these areas was attributed to the forest tent caterpillar; due to access issues no ground truthing was carried out to verify the causative agents of defoliation.

Overall, as predicted in 2006, the extent and intensity of insect pest-caused aspen defoliation decreased in 2007 compared to the corresponding figures in 2006 (Figures 10 and 11). In the Peace Area defoliation was found over a gross area of 4328 hectares, almost a 98% drop compared to the area defoliated in 2006. Most (87.2%) of this defoliation was moderate and the remainder (12.8%) was light. Neither aspen decline nor kill was observed in the Area. In the Peace Area defoliation was light north of Doig Fire Lookout and moderate south of this Lookout. In the Upper Hay Area defoliation was found over a gross area of 66,790 hectares, a 98% drop compared to the area defoliated in 2006. All of this defoliation was moderate indicating possible further decline in this infestation. The aerial surveyors recorded defoliation west of Hay River, south of Indian Cabins, south of Wentzel Lake and east of Footner Lake. Defoliation was also recorded on the north side of the Peace River in the Township 105 Range 16 and Township 107 Ranges 15-17 West of 5th Meridian.

Southwest Alberta (Woodlands, Foothills, Clearwater and Southern Rockies Areas)

Insect pest-caused defoliation was observed over a gross area of 767,866 hectares in southwest Alberta (Figure 11). This was almost a 92% increase compared to 401,010 hectares defoliated in 2006. Defoliation was light over 139,103 hectares (18%), moderate over 590,159 hectares (77%) and severe over 38,604 hectares (5%). Table 7 shows the distribution of this defoliation by severity categories among the Areas in southwest Alberta.

Table 7
The extent of insect pest caused aspen defoliation by severity categories in southwest Alberta, 2006 vs. 2007.

Corporate Area	**Gross area of defoliation (ha)**					
	2006			**2007**		
	Light	**Moderate**	**Severe**	**Light**	**Moderate**	**Severe**
Southern Rockies	0	90,043	0	23,297	36,100	3123
Clearwater	32,950	6191	34,088	15,063	131,963	7029
Foothills	3006	25,615	0	59,935	242,041	25,033
Woodlands	132,923	76,194	0	40,808	180,055	3419
Subtotal	168,879	198,043	34,088	139,103	590,159	38,604
Grand Total		**401,010**			**767,866**	

Southern Rockies and Clearwater Areas

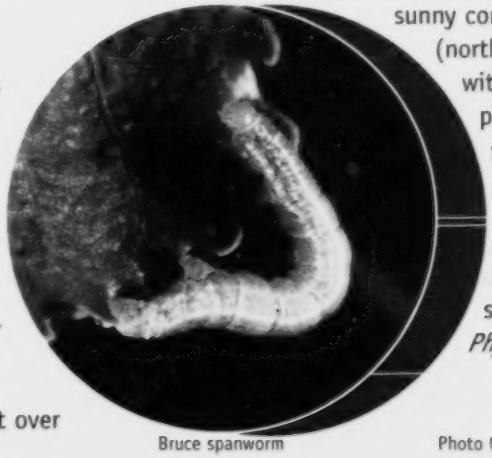
The Forest Health Technicians, Rupert Hewison, Bart McAnally and Trisha Stubbings surveyed aspen defoliation on June 27 and 28. The surveyors flew in a fixed-wing aircraft (Cessna) under clear skies for 12 hours in a zig-zag pattern over the eastern parts of these Areas. They recorded results of these surveys by using a digital tablet personal computer linked to a global positioning system. The results of the aerial overview surveys are shown in Figure 11 and Table 7. These results were not verified by ground truthing.

The forest tent caterpillar defoliation was found over a gross area of 62,520 hectares over the Southern Rockies Area. This is a 31% decline compared to 90,043 hectares defoliated in 2006. Defoliation was light over 23,297 hectares (37.3%), moderate over 36,100 hectares (57.7%) and severe over 3123 hectares (5.0%) (Table 7). Aspen defoliation was found north of Sundre along Highway 22, east of Drayton Valley and west of Porcupine Hills (Figure 11).

In the Clearwater Area, forest tent caterpillar defoliation was scattered over an estimated 154,056 hectares, an increase of 110% compared to 73,229 hectares defoliated in 2006 (Figures 10 and 11). Defoliation was light over 15,063 hectares (10%), moderate over 131,963 hectares (86%) and severe over 7029 hectares (4%).(Table 7)

Foothills Area

The Forest Health Officer, Brooks Horne, surveyed the Area to record aspen defoliation. Although aspen defoliation was attributed to the forest tent caterpillar, the Bruce spanworm (BSW) occurred in early June and it was almost as widespread. This defoliation occurred over a gross area of 327,009 hectares (Figure 11). Defoliation was light over 59,935 hectares (18.3%), moderate over 242,041 hectares (74.0%) and severe over 25,033 hectares (7.7%) (Table 7). The BSW that preceded the forest tent caterpillar was found almost throughout the Area; most of the defoliation by this pest was patchy and occurred west of Edson and Hinton. The forest tent caterpillar occurred in mid-June and it was as widespread as the BSW. The forest tent caterpillar defoliation was more visible east of Hinton.



Bruce spanworm

Photo Credit: E. Bradford Walker, Vermont Department of Forests, Parks and Recreation, Bugwood.org

Woodlands Area

Forest tent caterpillar (FTC) defoliated 224,282 hectares in this Area (Figure 11). The FTC replaced the large aspen tortrix (LAT), which was the main aspen defoliator in 2006. The extent of aspen defoliation increased slightly (7%) compared to 209,117 hectares defoliated in 2006. Severity of defoliation increased in 2007 with light defoliation over 40,808 hectares, moderate defoliation over 180,055 hectares and severe defoliation over 3419 hectares (Table 7).

National Parks

Wood Buffalo National Park

On July 19th, Roger Brett, the Supervising Forest Health Technician at the Northern Forestry Centre, Canadian Forest Service, Natural Resources Canada carried out an aerial survey over Wood Buffalo National Park (WBNP). He flew under a mix of sunny conditions with clear visibility (north) and wildfire-generated smoke with scattered showers that provided limited visibility in the south of this park. The results of this survey are shown in Figure 11.

A large infestation of the aspen serpentine leafminer (ASL), *Phyllocnistis populiella* (Chamb.) has

been ongoing in the park for a number of years. This was part of a much larger outbreak that spanned to the Northwest Territories from east of Fort Resolution to the Mackenzie Mountains. It was unclear how far north up the Mackenzie River the infestation covers. The damage was more severe in the west (Fort Simpson/Fort Liard area) than in the east (Fort Smith/Fort Resolution) of WBNP.

The ASL affected approximately 52 420 hectares of aspen forests in the park and the Fort Smith/Fort Resolution area. Although trace amounts of leaf mining was observed from the ground from Pine Lake to Peace Point, the vast majority of the outbreak resided north in the Pine Lake, Fort Smith, Fort Resolution, Hay Camp, and Salt River areas. Most of the outbreak was classed as light-to-moderate, although there were several patches of moderate damage.

The damage caused by ASL, although appeared to be severe, was not killing trees. The mining of aspen leaves may result in a slight reduction in radial growth and premature dropping of leaves but the long-term health of trees was unaffected, even after repeated annual attacks.

The large aspen tortrix (LAT), *Choristoneura conflictana* (Walker) population observed over the last few years in Wood Buffalo National Park collapsed in 2007. Although trace amounts of defoliation could be observed from the ground along the Hay Camp and Peace Point roads, the vast majority was unnoticeable from the air. Only one small pocket (ca.147 hectares) of LAT defoliation was mapped in the Wood Buffalo National Park.

Large aspen tortrix larvae

Diseases and Disorders

Foothills Forest Area

White pine blister rust, *Cronartium ribicola* J.C. Fischer, affected whitebark pine in Willmore Wilderness Park. The disease occurrence was highest in western transects located closest to low mountain passes in BC. The trees in Deveber and Fetherstonhaugh drainages were hardest hit.

Brooks Horne, the Forest Health Officer, carried out a transect survey on incidence of this disease in the park. Out of the nine transects, one had 13% of the trees with WPBR stem cankers, six transects had up to 6% of the trees affected and two transects had no diseased trees. Five of the nine transects had trees with up to 16% branch cankers and four transects had branch canker free trees. The current occurrence of the disease was localized but it is bound to spread further in the provincial park.

Southern Rockies Area

The Forest Health Officer, Christie Ward, received several field reports of Armillaria root disease killing mature pines in areas east of Bragg Creek.

Forest Pests in Urban Forests

Insect Pests

In the City of Edmonton, the 2007 growing season started out with fairly high moisture but this was followed by a summer of hot, dry weather. This allowed trees stressed by dry conditions in recent years to recover some vigour early in the season but also provided favourable conditions for many tree pests in the Edmonton area. Many trees that were hard hit in previous years were able to recover. Trees that had little or no problems in previous years had some increase in pest occurrences.

Outbreaks of mountain pine beetle in the province prompted setting-up of a series of pheromone-baited traps to monitor presence of the beetle in Edmonton. No mountain pine beetles were collected from these traps, and no signs or symptoms of mountain pine beetle were found on city trees. As a preventative measure, several hectares of pine forest in the North Saskatchewan River valley were outfitted with Verbenone anti-aggregating pheromone sachets.

During increased monitoring for mountain pine beetle, symptoms tentatively identified as those of pine bark adelgid (*Pineus strobi*) were found on several trees in the Edmonton region.

Spruce trees continued to be hard hit by pests in 2007. Yellowheaded spruce sawfly (*Pikonema alaskensis*) remained ubiquitous and 3525 trees were sprayed to control this pest (compared to 4500 trees sprayed in 2006).

Spruce budworm damage

Spruce budworm (*Choristoneura fumiferana*) population in Edmonton increased in 2007. Just over 1000 spruce trees were injected with Orthene® (acephate) to control the spruce budworm. Monitoring of these trees showed excellent control of yellowheaded spruce sawfly on the treated trees.

Spruce beetles (*Dendroctonus rufipennis*) were found in a small number of trees in the vicinity of McKinnon Ravine. These beetles may have contributed to the mortality of several spruce trees.

Spruce spider mite (*Oligonychus ununguis*) infested many spruce trees throughout Edmonton. Combined with yellowheaded spruce sawfly and remaining stress from drought conditions, some of these trees were showing definite signs of declining health.

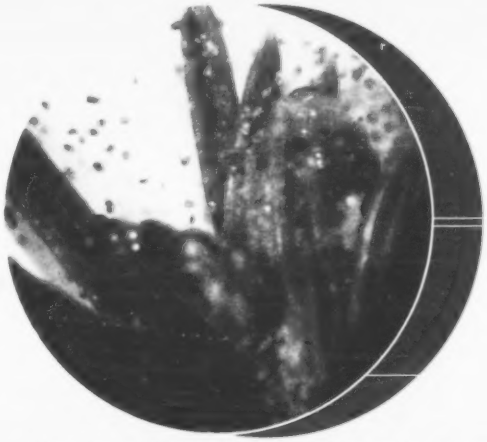


Photo Credit: USDA Forest Service - Ogden Archive, Bugwood.org
Spruce spider mite

Several spruce trees were infested with the spruce zebra beetle (*Xyletrechus undulatus*). This species also showed up in some of the mountain pine beetle traps.

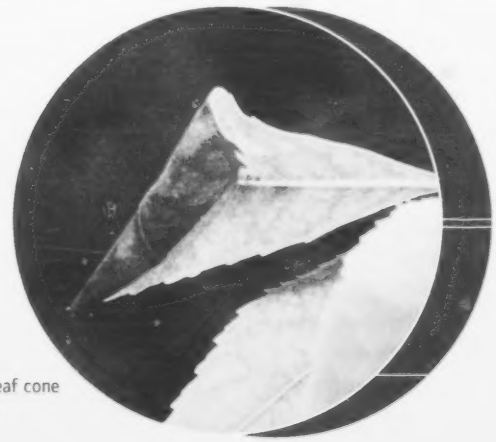
On tamarack, the larch sawfly (*Pristiphora erichsonii*) numbers increased with several trees in the river valley showing heavy defoliation. The spruce gall adelgid (*Adelges lariciatus*) was also noted on several tamaracks in the Edmonton region.

Ash trees in Edmonton were particularly hard hit in recent years. Drought conditions and a wide variety of pests, with new species seemingly arriving every year, have killed a large number of ash, especially black ash. In 2007, following a campaign of injecting Orthene (acephate) into many trees as well as increased pruning of boulevard trees, ash trees were doing much better.

The difference in vigour between black ash treated with Orthene to control the cottony psyllid (*Psyllopsis discrepans*) and untreated trees was dramatic. This lends credence to the idea that the cottony psyllid is

a more serious pest than originally thought. Initial data seem to indicate that Orthene is more effective than Confidor (imidachloprid) against the cottony psyllid.

The ash leaf cone roller (*Caloptilia fraxinella*) remained widespread throughout the city, but numbers per tree appeared to be decreasing. Parasitism of the leaf roller larvae by a braconid wasp (*Apanteles* sp.) was levelling off to become more uniform across the city. In previous years these parasites were clumped in some neighbourhoods with high parasitism rates, while other neighbourhoods had little or no signs of the parasitoid wasp. In 2007, several neighbourhoods that were previously heavily parasitized showed lower proportions of parasitism, while neighbourhoods where the wasp occurrence was rare showed increased numbers. Overall, numbers of the parasite seem to be increasing city-wide.



Ash leaf cone roller

Ash plant bug (*Tropidosteptes* spp.) numbers dropped throughout Edmonton. Injection of trees with Orthene seemed to be fairly effective against ash plant bug, and even trees treated in 2006 summer had decreased ash plant bug populations through 2007.

Number of trees infested with western ash bark beetle (*Hylesinus californicus*) remained high, but did not increase as much as in previous years. Healthier trees and more active pruning of dead wood from infested trees seemed to alleviate the damage caused by this insect. The related Criddle's bark beetle (Hylesinus criddlei) was also identified from several sites in Edmonton.

Spiny ash sawfly (*Eupareophora parka*) was found in low numbers throughout the city. In some areas, almost every tree had at least some visible damage due to these sawfly larvae.

The ash leafcurl aphid (*Prociphilus fraxinifolii*) noted on several trees in 2006 seemed to have almost completely disappeared in 2007. Perhaps a dearth of fir trees (*Abies*) in Edmonton, which serve as the alternate host for this ash aphid, prevented them from completing their life cycle.

The forest tent caterpillar (*Malacosoma disstria*) was found scattered throughout Edmonton in medium numbers. Although not very noticeable at this time, this is probably most forest tent caterpillars seen in the city in the past 20 years.

Satin moth (*Leucoma salicis*) numbers and distribution also increased in Edmonton. Although this pest was earlier confined to a few small areas in the south side of the city, in 2007 individual trees throughout the city and in the outskirts started showing medium to high defoliation. The braconid wasp *Cotesia* found in fairly high numbers on many of these trees may help to keep the satin moth populations from exploding into outbreak conditions. This generalist parasitoid may also help to limit numbers of other pests, such as the forest tent caterpillar.

Photo Credit: Ferenc Lakatos, University of West-Hungary, Bugwood.org
Satin moth larvae

Bruce spanworm (*Operophtera bruceata*) is also becoming much more common, and defoliated a number of aspen poplars south and east of the city.

Other poplar defoliators, including the large aspen tortrix (*Choristoneura conflictana*), linden looper (*Erannis tiliaria*), aspen leafroller (*Pseudoexentera oregonana*), aspen twoleaf tier (*Enargia decolor*), and oblique banded leaf roller (*Choristoneura rosaceana*) were found in increasing numbers. In some areas, these pests were occurring simultaneously.

Urban poplar plantings are favoured by the poplar borer (*Saperda calcarata*). Columnar aspen seemed to be especially attractive to the beetle. Some initial results with acephate injections in infested trees were promising, with little or no production of sawdust following injection.

In addition, a number of trees with symptoms consistent with bronze leaf disease of poplar (*Apioplagiostoma populi*) were identified mostly in Swedish columnar aspen. No diagnoses have been confirmed to date.

Amber-marked birch leaf miner (*Profenusa thompsoni*) was less common in 2007, possibly due to decreased number of birch within Edmonton's urban forest. Birch that remained were generally in poor shape, and many showed signs of secondary infestation by bronze birch borer (*Agrilus anxius*).

The larger boxelder leaf roller (*Archips negundana*) caused almost complete defoliation of a number of Manitoba maples in the river valley of Edmonton. The trees recovered quickly and signs of defoliation were difficult to find three weeks after the peak of activity. Linden looper (*Erannis tiliaria*) was also found on many of these trees. Fall cankerworm (*Alsophila pometaria*) numbers, which had been increasing around the same area, dropped drastically possibly due to competition with the leaf roller.

Oak galls, such as those caused by the oak rough bulletgall wasp (*Disholcaspis quercusmamma*) and Cynipid gall wasps were common. Most oak trees in Edmonton showed at least a few galls, but numbers did not seem to be increasing.

Viburnum leaf beetle (*Pyrrhalta viburni*) was found in the Edmonton area in 2007. This pest is a serious defoliator of Viburnums, particularly high-bush cranberry (*Viburnum opulus*).

Diseases and Disorders

Dothiorella wilt (*Dothiorella ulmi*) continued to cause decline of hundreds of Edmonton area elm trees. Another 52 cases of this disease were confirmed in 2007. Preliminary work with the registered fungicide Eertavas was promising. It is hoped this product might be used to combat decline of trees from Dothiorella wilt.

Exotic Pests

A series of pheromone-baited Delta traps installed in conjunction with the Canadian Food Inspection Agency (CFIA) did not catch any gypsy moths (*Lymantria dispar*) in the city. There have been no gypsy moth captures since adults of this moth were caught at two sites in 2003.

In monitoring for the Dutch elm disease vector, the smaller European elm bark beetle (*Scolytus multistriatus*), one beetle was caught in one of the pheromone-baited traps in May 2007. This is the earliest this beetle has ever been found in the Edmonton area, but it was the only beetle caught during the entire season. This catch is down from five beetles caught in pheromone-baited traps in 2006.

In cooperation with the CFIA three sets of chemical lure-baited Lindgren funnel traps were set up in the Edmonton area to detect the presence of exotic forest insect pests. In 2007, these traps did not catch any insects of significance, but did capture a wide variety

of beetles that included Scolytids, Elaterids, Buprestids and Cerambycids. These specimens are still being identified.

There were no signs of any major, exotic invasive species, such as the emerald ash borer (*Agrilus planipennis*), Asian long-horned beetle, (*Anoplophora glabripennis*), wood wasp (*Sirex noctillio*), sudden oak death (*Phytophthora ramorum*, or banded elm bark beetle (*Scolytus schevyrewi*), occurring in the city in 2007.

Forest Invasive Alien Plants

Provincial

In 2007, SRD conducted a number of Regional/Area projects, as well as projects to support the Alberta Government's inter-departmental and inter-provincial cooperation on invasive species.

The Interdepartmental Invasive Alien Species Working Group (Working Group) further advanced the development of an Invasive Alien Species Management Framework and supporting Risk Assessment Tool (RAT). The draft Framework was distributed to partners for feedback on the proposed process. Generally, there was support for this conceptual system that incorporates the stages of identification, risk assessment, appropriate response, and communication to effectively manage invasive species in Alberta. The next step is for the Working Group, together with its Alberta partners, to determine the roles and responsibilities of agencies and groups within the Framework.

The Working Group is in the final stages of preparing the invasive alien species RAT for use in 2008. Based on feedback received at an expert panel review of the tool held in 2007, the Working Group expanded the socio-economic portion of the assessment and will be improving the tool's calculation function to appropriately score risk. Following the completion of these improvements, the RAT will be converted into a web-based application accessible on-line.

In addition to developing the Framework and the RAT, the Working Group:

- provided an Alberta perspective on the development of federal government and inter-provincial initiatives;
- participated on initial discussions for the development of a provincial pest surveillance system;
- developed the first draft of contents for a Government of Alberta invasive species website;
- collaborated with the Alberta Invasive Plants Council (AIPC) on the development of a number of invasive plant fact sheets (available at www.InvasivePlants.ab.ca); and,
- provided Government of Alberta representation to the AIPC through membership on the board of directors.

Initiatives specific to SRD in 2007 included the initiation of a project to standardize and consolidate invasive plant survey, control and compliance information collected and stored by all program areas with the department. The Geographic Land Information Management & Planning System (GLIMPS) will be expanded to store and report invasive plant data. Although some of the invasive plant functionality within GLIMPS will be rolled out in stages in 2008, it is anticipated that the project will not be completed until the start of the 2009 field season.

In spring 2007, promotional items were produced by the Forest Health Section and provided to the Areas for distribution to public and industry partners. These items included mechanical pencils, sticky notes and magnetic clips. The message on the pencils and pads read "HELP STOP the Spread of Invasive Plants."

In 2007, Forest Health staff in Edmonton consolidated all of the invasive plant survey information collected by the Forest Health program for the years 1998-2007. From this data set, provincial distribution maps of the most common

species were made. These maps (Figures 13-18) are shown at the end of the invasive plants section of this report.

Note: Scientific names of the invasive plant species listed in the regional reports can be found in Appendix III.

Regional

Smoky (NW1)

A forest health officer was dedicated to the weed program in the Smoky Area for the first time in 2007. Priorities for the year were to adopt the Peace Area's management plan to survey and control invasive plants. The weed surveys carried out prior to 2007 were inconsistent with the provincial standards.

Two forest health technicians were hired to complete weed surveys as well as mountain pine beetle work. Throughout the summer six SRD staff assisted in conducting weed surveys as time permitted.

Education, Awareness and Co-operative Initiatives

Invasive plant staff from the Smoky Area attended two workshops, i.e., one held in Rycroft and the Second Annual Northeast Alberta Invasive Plant Spring Workshop held in Athabasca.

With regard to coordinating activities between SRD and Municipalities, discussions with the County of Grande Prairie took place to prioritize and direct SRD surveys. As well, phone conversations occurred with the County of Saddle Hills to learn of trouble spots which they were encountering.

Surveys and Control

In 2007 a total of 191 sites were surveyed.

Frequency of invasive plant occurrences:

Sites with invasive plants	61%
Sites without invasive plants	39%

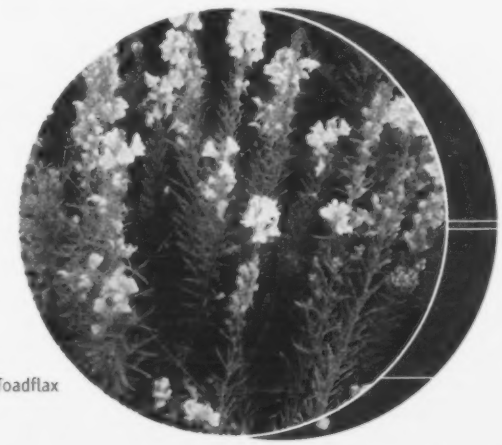
Frequency of species occurrences on sites with invasive plants:

Canada thistle	43%
Scentless chamomile	25%
Perennial sow-thistle	21%
Ox-eye daisy	4%
Tall buttercup	2%
Common tansy	2%
Cleavers	1%
Common toadflax	1%
Bull thistle	1%

Frequency of degree of infestations on sites with invasive plants:

Trace	82%
Low	7%
Moderate	8%
High	3%

Of the area surveyed this year, the highest densities of noxious weeds were located in Ranges 3 – 8, Township 75, west of the 6th Meridian. This area is surrounded by farms and private land.



Toadflax

One hundred three notices were sent to disposition holders. All companies were contacted by phone before notices were sent to confirm contact information and inform them of the sites where weeds were found. Most of these companies were called from mid- to late July and many had already started their weed control program for the season. Companies were asked to reply to the letters to inform SRD of sites that had been controlled.

Eleven scentless chamomile sites were controlled by hand-pulling at the time of the survey. These sites will be revisited in 2008.

Herbicide was applied at two locations to control invasive plants in 2007:

- Revoked Dobbyn Grazing Lease (24/25 – 68 – 5 – W6M)
- Blueberry Trails 79/80 – 8/11 – W6M

The Dobbyn lease is a revoked grazing lease covering approximately 17 hectares. Approximately 5% of the area is infested with Canada thistle. The area encompasses 5 small fields (1 to 8 hectares in size) with several connecting trails. The area has been a challenge to control, in part due to the many ATV trails connecting the fields. Portions of area have been treated with herbicide since 2003. The area was also treated with prescribed fire in 2005 and 2006. The size of the infestation has been continuously reduced. Most of the open areas now have very little Canada thistle with the edges of openings and up to 30 metres into the forest remaining to be controlled.

The Blueberry Trails area covers approximately 8 hectares, 15% of which is moderately infested with Canada thistle. Trace amounts of scentless chamomile and perennial sow-thistle cover over 0.1% of the area. Due to wet conditions and other spray contract commitments, the contractors completed just over half of the infested sites targeted for control. Overall, spray efficacy was good, with only 5% of the Canada thistle not being completely destroyed.

Lesser Slave (NW2)

Two invasive plant surveyors were employed in the Lesser Slave Area this summer; Crystal Ionson and Shawna Lund. Priority areas inspected this summer were the Utikuma and Swan Hills areas.

Education, Awareness and Co-operative Initiatives

Invasive plant materials were distributed throughout the spring and summer to the public and other stakeholders. Materials distributed included: invasive plant calendars, magnetic clips, notepads, pencils, and brochures. The Municipal District of Lesser Slave River was also contacted to obtain weed management pamphlets for distribution.

Both surveyors and Area Forest Health staff attended the 2nd Annual Northeastern Alberta Invasive Plant Spring Workshop in Athabasca.

Surveys and Control

This season parts of the Utikuma and the Swan Hills areas were surveyed.

In 2007 a total of 319 sites were surveyed for invasive plants; all of which were occupied Crown land.

Frequency of invasive plant occurrences:

Sites with invasive plants	74%
Sites without invasive plants	26%

Frequency of species occurrences on sites with invasive plants:

Perennial sow-thistle	44%
Canada thistle	37%
Scentless chamomile	18%
Tall buttercup	1%

Frequency of degree of infestations on sites with invasive plants:

Trace	5%
Low	23%
Moderate	61%
High	11%

SRD sent letters to each company that had noxious weed detected on their disposition(s). The letters detailed the survey results and asked the company to control the infestations by July 15, 2008. Re-inspections will follow.

Re-inspections of infested dispositions noted in 2006 took place in the Utikuma area in 2007. Surveyors noted that even though most of the sites were sprayed and mowed, the populations were the same or worse than in the previous year. During summer 2007, sites were again sprayed and mowed in an attempt to achieve more positive results.

Peace & Upper Hay (NW 3 & 4)

In 2007 three dedicated SRD invasive plant surveyors worked in the Peace and Upper Hay areas. Danny Brown covered the Upper Hay Area, and Hope Klein and Nicolas Martel covered the Peace Area.

Overall conditions in 2007 were very wet. Invasive plant population dynamics appeared to be consistent with other years. Populations continued to grow due to lack of control efforts by stakeholders.

Education, Awareness and Co-operative Initiatives

Limited educational material was distributed. The last of the invasive plant signs was posted in Worsley.

SRD invasive plant program staff participated in two workshops, one in Athabasca and the other in Rycroft (held by the Agricultural Fieldsmen's Association). Meetings were held with the surrounding Municipal Districts (MD) in the Peace Area, but not in the Upper Hay Area due to limited interest in invasive plant surveying or control by the Municipality.

Plans are to initiate some cooperative management programs in the Peace Area in 2008.

Surveys and Control

The locations surveyed in the Peace Area were mostly in the MD of Northern Sunrise County, especially in the Marten River and East Haul Road areas. Some surveys were carried out in the Keg River area.

In the Upper Hay Area, Assumption Hill, the Shekilie area, Negus Creek, and Chinchaga River just north of Paddle Prairie were all surveyed.

Both Peace and Upper Hay areas concentrated on surveying leased land (typically by oil and forestry companies) within the green zone. Typically both areas are exposed to the same invasive plants each year: perennial sow-thistle, Canada thistle, scentless chamomile with some common toadflax and tansy. In 2007, all these species were recorded.

The biggest concern was the lack of treatment of perennial sow-thistle in NW4. It is not treated as an invasive plant, and many companies will control Canada thistle and scentless chamomile, but will leave the perennial sow-thistle.

In 2007 a total of 503 sites were surveyed in the Peace and Upper Hay areas

Percent of Sites surveyed on vacant vs. occupied land:

Vacant	1%
Occupied	99%

Frequency of invasive plant occurrences:

Sites with invasive plants	87%
Sites without invasive plants	13%

Frequency of species occurrences on sites with invasive plants:

Perennial sow-thistle	58%
Canada thistle	22%
Scentless chamomile	19%
Common tansy	<1%
Knawel	<1%
Ox-eye daisy	<1%
Common toadflax	<1%
White cockle	<1%

Frequency of degree of infestations on sites with invasive plants:

Trace	35%
Low	35%
Moderate	24%
High	6%

Of the 503 sites surveyed, 284 of those were re-inspections of previously surveyed sites where the occupant had been notified of invasive plants on the lease. Letters were sent to 214 leaseholders notifying them of invasive plants on their dispositions.

In 2007, SRD contractors treated the following invasive plants with herbicide:

- Upper Hay: 12 hectares of common tansy and perennial sow-thistle

Canada thistle

- Peace: 2.5 hectares of perennial sow-thistle, Canada thistle and scentless chamomile

In the sprayed areas, control efficacy was good; plants did not survive to seed. However, more than half of the locations that were supposed to be controlled were not treated by the contractor. To avoid this in the future, contracted spray crews will be more closely supervised by an SRD employee.

A trial on biological control of scentless chamomile was initiated in 2006 to determine the northern survival and control capabilities of a seed weevil (*Omphalapion hookeri*), and a gall midge (*Rhopalomyia tripleurospermi*).

Four locations were chosen, where scentless chamomile populations were high and dispersed, and human traffic was low or controlled. The insect releases took place in late July 2006 (9 galled plants were transplanted) and early September 2006 (500 weevils were released onto existing plants) at each of the 4 sites.

Site #1 - CNRL Wellsite, MSL 840462, 9-21-80-17-5, 55.94493 -116.58961

At the time of the weevil release (September 2006) the scentless chamomile plants on the release site had not yet gone to seed and the population appeared healthy. New galls had formed on the transplanted scentless chamomile and a single new gall was forming on a neighbouring plant.

On June 29, 2007 the site was inspected for possible signs of gall and weevil survival. The plants were still quite small and there was no sign of galls, but 3 adult weevils were found 5 meters southwest of the release site. On August 2, 2007, the site was inspected and no galls were found. The grass growing among the scentless chamomile in the release site had outgrown the weed and very few chamomile plants were still visible in that 3x3 meter space. However, 3 adult weevils were found within this area.

By our final inspection on August 31, 2007, the chamomile was no longer present at the release site and 11 adult weevils were found south of the release site. No galls were found.

Site #2 - Orlesky's Farm, NW6-101-23-53, 57.73736 - 117.75028

At the time of the weevil release (September 2006) 4 of the transplanted chamomile plants had died. When the galled plants were planted, the ground was very wet and it is possible that some were not completely covered with clay and may have dried out. On the remaining transplanted chamomile, some new galls had formed. No galls had formed on surrounding chamomile.

During the first summer inspection, on June 26, 2007, no galls or weevils were found. The chamomile was close to flower. On August 2, 2007, 17 galls and 2 weevils were found. The galls were present up to 5 meters from the release site. Although the results seemed promising, the landowner had been requested by his Municipal District to control his invasive plant problem immediately using chemical treatments.

Spraying did not take place until after the final inspection (August 30, 2007). An additional 9 galled plants were found, as well as some additional galls on previously counted plants. No weevils were found. A Municipality representative was present and the galled plants were pulled in order for the landowner to meet control requirements.

Scentless chamomile

Site #3 - HWY 58, 13-23-110-24-5, 58.57045 - 117.90440

This was the least successful site. There was no evidence of gall or weevil survival one year after release. It was the most northern site and also the most accessible. It is possible that a combination of climate and human interference could have affected the survival of the agents.

Site #4 - Husky Wellsite, 7-14-108-9-6, 58.37437 - 119.37252

At this site, the chamomile population was very hearty and had spread widely in the year since the release. Although no galls were ever located, 3 adult weevils were found during the final inspection on August 23, 2007.

In conclusion, this experiment provided valuable information about the biological control agents' ability to over-winter in a northern climate and their possible affects on virulent chamomile populations. It is probable that the climate past the 108th Township may not be suitable for either agent, but in all the other locations, their presence has the potential to be a detriment to chamomile populations. SRD will continue to monitor both wellsite locations next summer, in an attempt to document more incidences of agent survival and chamomile population decrease.

Lac La Biche & Waterways (NE 1 & 2)

In the Waterways and Lac La Biche areas, the 2007 growing season started generally with sufficient spring moisture to provide vegetation good initial growth indices, especially in the southern portion of the areas. A favourable temperature and moisture regime was followed by a hot and dry July which reduced available moisture considerably. Subsequently, August had somewhat more precipitation than normal and much cooler temperatures. This information was obtained through SRD climate maps and personal communications with SRD staff throughout the areas.

The 2007 weather pattern led to average cereal crop production in the settled areas of the region, with the bulk being there but not the weight (personal communication with local farmers). This generality may also be applied to the growth of noxious weeds within the region, with deep rooted species such as common tansy and Canada thistle benefiting from the overall drier conditions. The other more shallow-rooted noxious weeds present in the area appeared to have had an "average" production season.

Primary SRD staff involved with the 2007 Waterways/Lac La Biche Weed Program were Martin Robillard, Aleksandra Holod and Carliegh Brown, working under the supervision of Tom Hutchison (Forest Health Officer, Waterways/Lac La Biche Area). Technical assistance was provided by various SRD staff throughout the region.

The program priorities were consistent with previous years: Any unoccupied crown land within the Green Zone that had noxious weeds was top priority, and a higher emphasis was placed on actual SRD dispositions. Inventories on vehicle-accessible geographic areas that had not been inventoried in the last three years were also prioritised.

Notification letters, in consultation with the local SRD Land Use Officer, were sent out to disposition holders known to have weed problems on those locations.

One SRD staff held a Pesticide Applicator Certificate, which allowed for knowledgeable and timely weed management decisions being made in conjunction with disposition holders and vegetation management consultants.

One staff member was retained for the winter of 2007 to create a comprehensive plan for the 2008 season.

Education, Awareness and Co-operative Initiatives

2nd Annual North Eastern Alberta Invasive Plant Workshop

On May 31, 2007 the 2nd Annual Northeastern Alberta Invasive Plant Spring Workshop was held in Athabasca. This workshop was hosted by Alberta Sustainable Resource Development as part of the Area's Cooperative Invasive Plant Working Group.

The target audience for this session was SRD and industry field staff. Topics included "Invasive Plant Biology and Identification", "Invasive Plant Inventory Techniques" as well as "Legislation and Risk Assessment of Invasive Plants". An overview of the invasive plants scene in other parts of the province was also discussed. This included the successful "tall buttercup Control Program" that had previously been completed in the Rocky Mountain House Area and "What's Happening in the Northwest". The topics explored different management options wherever applicable. One other session of particular interest was the "Use of Grazing to Control Noxious Weeds" by Tom Krawec, an Athabasca area rancher. Tom explained how he could get various species of livestock to consume different species of noxious weeds.

A number of interactive activities were also included during the workshop. These included such things as a "Name That Weed Contest" and an "Inventory/ Legislation" contest. The final activity of the day was a "Who Wants to Be a Millionaire – Invasive Plants Edition". The game was a success and participants requested that it be presented again at the 2008 spring workshop.

The workshop was well attended by interested parties from many locations throughout northeast Alberta (and northwest Saskatchewan). Approximately 70 participants provided a good representation of the oil/gas industry, forest products companies, various consulting companies and provincial government personnel.

Collaborative Work with Industry and Municipalities

Cooperation between SRD and private industry (i.e. the oil/gas, forestry, vegetation management, etc.) regarding weed issues in the northeast remains at an acceptable level. This is, in part, due to the emphasis placed on holding an annual workshop where different stakeholders have an opportunity to converse. In a general sense, the majority of disposition holders are aware of and making an effort to control noxious weeds on their properties (dispositions) as prescribed by law. SRD will continue to work with stakeholders to improve awareness, participation and compliance.

Within the Waterways/Lac La Biche areas, more proactive efforts are needed in some of the municipalities to deal with noxious weed issues. Most notably in the green zone where SRD's forestry program mandate is focused.

Weed Signage

A major initiative was undertaken in 2007 regarding signage. A total of 15 information signs were erected at new locations geographically spread throughout the region. Locations were determined in consultation with local SRD Land Use and Forestry Officers. An additional sign that was vandalized during the winter of 2006 was also replaced.

National Forestry Week and Public Inquiries

A comprehensive display and information booth pertaining to the noxious weeds of northeast Alberta was set up in conjunction with the National Forestry Week celebration held in Lac La Biche. This successful initiative was well attended by the public.

All public inquiries either in person or via the phone were handled. These inquiries were turned into an impromptu learning session whenever possible.

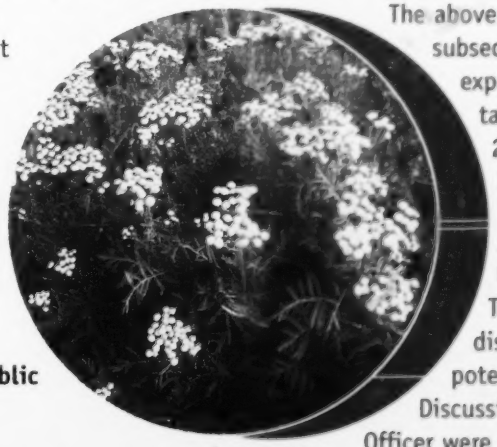
Surveys and Control

In keeping with SRD's initial objectives, invasive plant efforts on unoccupied (not currently under disposition) Crown lands were consistent with previous years. Most unoccupied Crown land appears to be relatively weed-free, however, it is uncertain how long this will last in those areas. There is no question these areas do need additional control work as most dispositions hold at least a trace amount of noxious weeds.

A concerted effort was made to conduct inventory surveys in selected locations north of the Cold Lake Air Weapons Range and the side roads off secondary highway 881 in the Conklin and Anzac areas. These locations were targeted as it had been a few years since any data had been gathered from Forest Invasive Alien Plants

The above targeted areas were subsequently found to be "dirtier" than expected. This information will be taken into consideration as the 2008 Invasive Plant Management Program is developed.

A major recreational road west of Fort McMurray (locally known as Tower Road, held under a SRD disposition) was identified as a potential control area for 2008. Discussions with the local SRD Land Use Officer were initiated.



Common tansy

Common tansy continued to thrive readily in many locations throughout the entire region. It was especially prevalent in Fort McMurray and all along the Athabasca River. Dr. Alec McClay of McClay Ecoscience is involved in researching and screening new biological control agents for common tansy.

This hopefully will lead to a breakthrough on tansy control in these areas.

White cockle appeared to slowly becoming more established and widespread. One notable infestation was identified in the City of Fort McMurray; subsequently the information was passed on to M.D. of Wood Buffalo officials.

In 2007 a total of 247 sites were surveyed.

% Sites surveyed on vacant vs. occupied land:

Vacant	3%
Occupied	95%
Unknown	2%

Frequency of invasive plant occurrences:

Sites with invasive plants	85%
Sites without invasive plants	15%

Frequency of species occurrences on sites with invasive plants:

Scentless chamomile	41%
Perennial sow-thistle	28%
Common tansy	16%
Canada thistle	8%
Tall buttercup	5%
Ox-eye daisy	1%
White cockle	1%

Frequency of degree of infestations on sites with invasive plants:

Trace	71%
Low	14%
Moderate	12%
High	3%

Of the survey sites where weeds were present, 175 had only one noxious weed species, 29 had 2 different species, and 7 had 3 different species.

In 2007, 18 compliance notifications were sent to disposition holders. This number did not include any notices sent out by SRD Land Use Officers that forest health program staff were not notified of. One Forest Land Use Officer (Bob Yowney – Athabasca) did notify our section that 3 notifications were sent to oil and gas industry representatives covering 18 separate dispositions within his working area.

Re-inspections took place at 15 sites where disposition holders were notified of weed infestations the previous year. Eleven of the 15 re-inspected sites were unsatisfactory. Thirteen of the 15 sites along with one inaccessible site have been added to the 2008 re-inspection ledger. This poor performance on behalf of these particular disposition holders does not necessarily reflect the overall attitude of industry towards the noxious weed problem.

Hand-pulling of noxious weeds was limited to approximately 60 sq. metres in 2007. This included 6 control efforts towards scentless chamomile, 3 for tall buttercup and 1 for white cockle.

Major weed control efforts (after verbal and/or written notification from SRD staff) were undertaken by Husky Energy, Canadian Natural Resources Ltd., and Alberta Pacific Forest Industries Inc., among others. It is expected notification from other disposition holders will arrive at this office later this year. Millar Western Forest Products Ltd. was also in contact with SRD in regards to 2 dispositions with invasive weeds. Their opportunity to spray in these specific areas was missed due to weather concerns.

Good communication between SRD, industry and vegetation control companies was the key for reasonable control efforts being made on noxious weeds.

This was the third year for the May Tower experimental tansy control project. The initial inspection revealed the Tansy in each plot has been reduced quantitatively. After clipping the flowers, a vinegar solution with dish soap as a surfactant was

sprayed on the 3 existing plots where tansy was present. A 7% solution of acetic acid (pickling vinegar) was used. A 4th plot was also established.

Southern Rockies (SW1)

A wet spring and hot conditions in mid-summer in the Southern Rockies Area contributed to desirable conditions for germination and flowering of invasive species.

Cattle and horses may be a significant contributor to the spread of invasive plants. Off road vehicles also contribute to a disturbed land base in which invasive plants may establish. The Castle and South Livingstone areas are prime examples of what kind of damage can be done.

Education, Awareness and Co-operative Initiatives

Participation in the Ed Gregor Stewardship Days facilitated dialogue with several people about the invasive plant program. Weed identification booklets, calendars and posters were handed out to people who had an interest in the program. In addition, numerous informal information sessions took place with a variety of individuals encountered in the field. In these instances, applicable information material was distributed.

Surveys and Control

In 2007 a total of 104 sites were surveyed.

Frequency of species occurrences on sites with invasive plants:

Canada thistle	36%
Oxeye daisy	25%
Tall buttercup	16%
Perennial sow-thistle	5%
Scentless chamomile	5%
Wild caraway	4%
Hound's tongue	3%
Common toadflax	2%
Bladder campion	<1%
Blueweed	<1%
Common Tansy	<1%
Creeping bellflower	<1%
Spotted knapweed	<1%

Frequency of degree of infestations on sites with invasive plants:

Trace	16%
Low	19%
Moderate	30%
High	35%

Control was primarily restricted to areas near Blairmore because it was the most heavily infested area. Secondary areas of control included: Sibbald Flats and the Porcupine Hills; each of these control programs lasted three days. No control was performed in the Ghost, Poll Haven or in the Mclean Creek area. Surveys identified problem areas by roadside and quad trails so these may be controlled in the future.

Surveys also identified a number of SRD facilities infested with a variety of species. These areas included: the Ghost Cadet Camp, Livingstone Gap Firebase, the abandoned Ranger Station on Highway 68 near Sibbald Flats, the Calgary Forestry office, and the Highwood Fire Base. These areas will be considered for control actions in 2008.

Ghost

All roads and staging areas in the Ghost Forest Land Use Zone were surveyed. Perennial sow-thistle and Canada thistle were found on the old road that is being reclaimed into a quad trail known as the "H" Road.

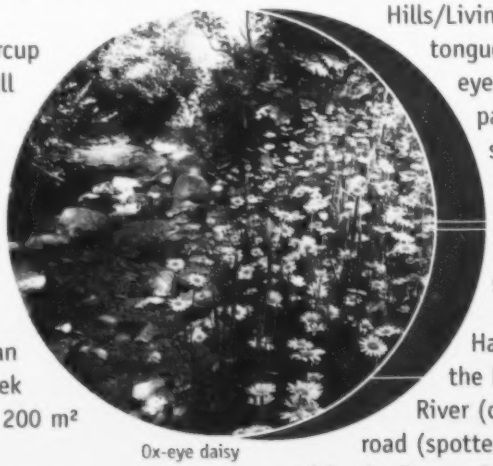
Along the southern portion of the "H" Road (access via the Harold Creek Road and traveling north), mature Canada thistle patches were recorded with a high degree of infestation (>25%) as large as 30 metre long by 5 metre wide. Juvenile Canada thistle was also found sporadically along the trail for several kilometres in patches smaller than 5 m^2. Perennial

sow-thistle had a much lower degree of infestation (<1%) and was not always present.

Along the northern portion of the "H" Road (access via Stud Creek Road and travelling south), no mature Canada thistle plants were present. The Canada thistle plants that had been found were juveniles in patches no bigger than 5 m². Single perennial sow-thistle plants were found at irregular intervals and were never more than trace infestations.

Mclean Creek

In the Mclean Creek off-road vehicle use area, common species encountered throughout included bladder campion, tall buttercup, Canada thistle and perennial sow-thistle. One interesting find was a tall buttercup plant that grew to 1.5 meters tall and almost 3 meters wide. No large-scale control was done in Mclean Creek; hand-picking of approximately 50 m² of scentless chamomile was undertaken. One large infestation of bladder campion was identified and recorded on an off road trail west of Mclean Creek Trail which was estimated to be 200 m² in size.



Ox-eye daisy

Highway 68/Sibbald Flats

Field scabious was the most common invasive plant in this area. The main flats located at the beginning of the Powderface Trail were heavily infested, as was the upper meadow located north of the Dawson Trailhead. The main flats area, where highway 68 intersects the Powderface Trail, was treated with herbicide in 2007.

A large-scale hand-picking operation took place over 2 days in August. Nine SRD mountain pine beetle crew members participated in hand-picking along the stream in the Flats, on some islands in the stream along the east side, in the horse corral, in the demonstration forest, along Bateman creek, along a stream west of Sibbald campground, and along the gated Shell road through the demonstration forest. In total, two truckloads of field scabious were picked.

Porcupine Hills/ Livingstone

The Municipal District (MD) of Ranchland was responsible for control of weeds as agreed to in a memorandum of understanding. The agreement provides the MD with a fixed budget to survey and control noxious and restricted weeds within the MD, on forest lands not under disposition.

Prevalent invasive species in the Porcupine Hills/Livingstone areas included hound's tongue, Canada thistle, bull thistle, ox-eye daisy, leafy spurge, and one patch of bladder campion. Other species of concern included spotted knapweed, tall buttercup, wild caraway, common toadflax, orange hawkweed, blueweed, and scentless chamomile.

Hand picking efforts took place in the Bob Creek area; along the Oldman River (ox-eye daisy); along the Maycroft road (spotted knapweed and leafy spurge); and in the Beaver Creek area (hound's tongue).

Some areas treated with herbicide included the Trout Creek Road and connecting logging roads (bull thistle); the Upper Willow Creek area (hound's tongue); and the Gap Fire Base Camp.

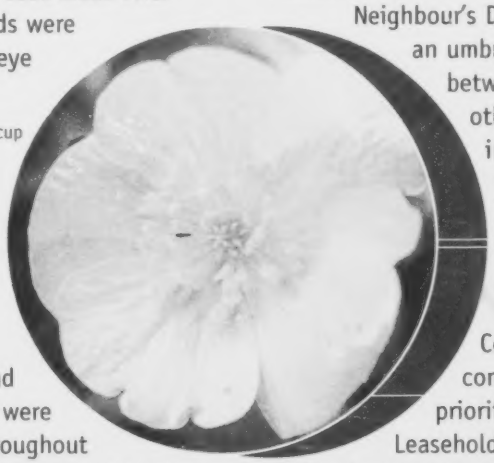
A release of the biological control agent *Mogulones cruciger* was carried out in late August for hound's tongue control in the southeast corner of the Porcupine Hills at N 49.79459 W -113.86897 (north of Ray Neadou's homestead). As well, a biological control agent release to control dalmatian toadflax took place at N 49.62425 W -114.46215 near the "bush pad" in the Crowsnest Pass, west of the golf course.

Castle

Quad tails, random camping and horse riding are common throughout the Castle area, and contribute to the introduction and spread of invasive plants. Of the areas surveyed, the most prevalent species included common toadflax, Canada thistle, and ox-eye daisy.

The Castle Crown Wilderness Coalition deserves special mention (notably Wendy Ryan) for their efforts in weed control. The group hand picked weeds at many sites in the Castle area such as the old minimum security camp and areas around Beaver Mines (including the area adjacent to the Big Sage area).

Herbicides were used to control invasive plants on the fire guard areas of the 2003 Lost Creek Fire. Species present on the fire guards were primarily Canada thistle and ox-eye daisy.



Tall buttercup

Poll Haven

Canada thistle, ox-eye daisy, and tall buttercup were the species of concern in the Poll Haven area. Surveys identified significant Canada thistle infestations along most trails and roads. Ox-eye daisy infestations were rampant in meadows located throughout the area. Bladder campion had been noted in the horse corals near the Northeast entrance of Poll Haven but absent everywhere else. Small wild caraway sites were identified in the Southern portion near the United States border.

Managing invasive plants in Poll Haven is a cooperative effort between Sustainable Resource Development (forestry and range programs) and the Grazing Association. Control in the Green Zone portion of this area was not completed due to a forest closure.

Clearwater (SW2)

Very warm temperatures in June & July, accompanied by regular rainfalls, aided germination and accelerated growth. In approximately two weeks, plants went from rosette stage to bolts in full bloom. August was quite cool by comparison. Ample moisture, kept vegetation green and blooming into September.

Education, Awareness and Co-operative Initiatives

All of the invasive plant awareness signs installed in 2006 were visited and all were in very good shape, with no graffiti or vandalism. No new signs were installed in 2007.

The Sundre Ranger Station Forest Officer attended the Sundre Petroleum Operator's Group (SPOG) Neighbour's Day on September 12th. SPOG is an umbrella group that supports dialogue between industry, landowners, and other activities such as grazing. As in the past, Neighbour's Day was phenomenally well attended and was an excellent opportunity to raise the profile of SRD's invasive plant program.

Co-operative weed management continued to be the first spending priority in the Clearwater Area. Leaseholder participation was consistent. The last portion of the Rig Street co-operative, a Head Tax Permit area south of Caroline was completed.

Sundre Forest Products participated in two additional co-operative spray projects; first one in the Williams Creek area and the second along Trout Road, north of Meadows Historical Cabin.

SRD sent emails to leaseholders requesting participation in treating a small area near Stafne Ridge. No response was received.

In fall 2007, letters of recognition were sent to all stakeholders involved in co-operative weed management initiatives, and the same will be done again in 2008.

Surveys and Control

In 2007 a total of 221 sites were surveyed.

Frequency of species occurrences on sites with invasive plants:

Wild Caraway	47%
Tall buttercup	31%
Canada thistle	10%
Common tansy	4%
Scentless chamomile	3%
Oxeye daisy	3%
White cockle	1%
Perennial sow-thistle	<1%
Common toadflax	<1%

Frequency of degree of infestations on sites with invasive plants:

Trace	19%
Low	26%
Moderate	34%
High	21%

The final phase of the Rig Street cooperative project, a Head Tax Permit grazing area south of Caroline, was the first priority. This area comprised about 2/3 of Township 35, Range 06. Primary weeds controlled in the area were wild caraway, tall buttercup and Canada thistle. The six participating leaseholders were Taylor NGL Ltd., Shell Canada Inc., Shiningbank Energy Ltd., Prime West Energy Inc., Fortis Alberta and AltaLink. This co-operative was a 3-year project.

The backcountry staging areas of the Wapiabi, Blackstone and Eagle Creek were the next priority areas. The coordinator applied herbicide on the weeds in the Eagle Creek and Hummingbird staging areas and random spots along Wapiabi Road during survey.

A contractor was hired to treat the flats at Blackstone River and some other sites west along the Gap road. The flats were looking very good – only scattered wild caraway and tall buttercup plants. The Provincial Recreation Area (PRA) beside the Blackstone River was also treated; the coordinator contacted Myles Jensen of Tourism, Parks & Protected Areas and he agreed to have the SRD contractor spray the wild caraway in the PRA and to pay for the work.

Many of the wild caraway sites that have been treated annually for the last few years are nearly eradicated; however more and more new wild caraway sites are appearing along the Forestry Trunk Road. The co-ordinator treated some infested sites, Clearwater County treated others, but some sites at the north end were left untreated. These sites were in Yellowhead County where caraway has not been elevated to the Noxious designation, and therefore Alberta Infrastructure & Transportation was not bound by the Weed Control Act to control the plant.

The 2004 Owl River Road Co-operative spray area was surveyed and the tall buttercup was sparsely populated through the area. Significant residual was still apparent. Touch-up control should be completed by 2009 to ensure the previously widespread infestation does not re-establish.

A small tall buttercup infestation near the old Clearwater Forestry Cabin seemed to have been eradicated. A much larger tall buttercup infestation was discovered in a hayfield, and this will need to be treated in 2008.

Foothills (SW3)

The 2007 invasive plants program began in May and ended in the last week of August. Brooks Horne, Forest Heath Officer, Christy Messier, Forest Health Technician and Caroline Charbonneau, Assistant Forest Health Technician led the program.

The goals were to identify areas with invasive plants, initiate control and educate a diverse group of people on the effects of invasive plants in the Foothills Area.

Education, Awareness and Co-operative Initiatives

A considerable amount of time was spent on preparing presentations for various groups of people. These groups were 10 members of a fire crew, 6 Girl Junior Forest Rangers (2nd yrs) and 5 Boy Junior Forest Rangers (2nd yr). A plant press was created to support the presentations made throughout the season. Three weed presentations were given in the Hinton Interpretive Park along with weed handouts followed by hand picking.

For Parks Day on July 21st, an information board was created which featured invasive plants. Various pamphlets were available along with invasive plants pencils. This board was presented on a table at the visitor's center in William A. Switzer Park along with the pressed plant exhibit that included six major species of weeds of the area.

Brent Korolischuk from Canadian Natural Resources Limited asked for an invasive plants presentation to be held at the Wildhay Gas Plant and at the Edson Curling Center Conference Room in August. The presentations involved weed pictures, live samples for identification, and a discussion on the issues and damage caused by invasive plants in Alberta. Approximately 100 people were present for these two combined presentations. Information pamphlets and "weed pencils" were handed out.

The 2nd year Girl Junior Forest Rangers put informational weed signs in the Area. These signs are designed to educate the public on invasive plants in the Foothills Area where heavy traffic occurs. Three new signs were placed; one along highway 40 North in William A. Switzer Park at the rest stop, another by the Athabasca bridge on Willow Creek Road, and the last one at the Obed Summit lookout point on Highway 16 west.

Posters and pamphlets were placed in various parks and recreational areas in the Area. The offices at Edson and Grande Cache received 100 weed pamphlets and 5 weed posters during the season, along with other various awareness products for the public.

Surveys and Control

Inspections for the 2007 season were focused mainly along Highway 40 North from Hinton to Grande Cache for approximately 5 weeks during June and July. Several accessible roads were examined, including major haul roads, cut block roads, oil and gas dispositions and public access points.

A total of 383 sites were surveyed in 2007.

Frequency of species occurrences on sites with invasive plants:

Tall buttercup	41%
Ox-eye daisy	37%
Perennial sow-thistle	11%
Scentless chamomile	6%
Canada thistle	4%
Common tansy	1%

Frequency of degree of infestations on sites with invasive plants:

Trace	N/A
Low	24%
Moderate	36%
High	51%

Letters of notification were then sent out to all disposition holders and their field consultants informing them of their weed infestations, the size of the area and the species of weeds found. A total of 67 dispositions were deemed infested within 20 companies. Copies were retained for office files and the letters were also given to either Yellowhead County or Greenview Municipal District.

Herbicide applications were planned to control invasive plants in the following six areas:

- Peppers Lake (SW 36-51-26-5)
- Chip Lake (NW 23-23-54-10-5) (SW 23-23-51-10-5)
- Old Rehn Mill (NE 8-51-10-5)
- Entwistle Gravel Pit (SW 8-53-7-5)
- Cynthia Reclaimed Well (SE 3-50-10-5)
- Pedley Gravel Pit (NW 10-52-24-5)

Herbicide was applied at all sites except the Chip Lake and Entwistle Gravel Pit sites. The smallest of the Chip Lake sites was not sprayed in the exact areas needed. On the large Chip Lake site, issues arose when a nearby farmer ploughed the field, eliminating the weeds on site. The main reason for not continuing with the spray program was due to alfalfa seedlings growing in the field. The southwest side of the Entwistle Gravel Pit was missed near the fence line and the gravel mounds should have also been added to the contract.

In addition to the control work conducted by SRD, the Hinton Interpretive Park was granted $4500 for invasive plant control. The park purchased herbicide for

Woodlands (SW4)

The Woodlands Area weed program started in May and completed in late August. Priorities were to inventory invasive plants at government facilities within the Woodlands Area.

Surveys and Control

In 2007 a total of 95 sites were surveyed.

% Sites surveyed on vacant vs. occupied land:

Vacant	30%
Occupied	70%

Frequency of invasive plant occurrences:

Sites with invasive plants	76%
Sites without invasive plants	24%

Frequency of species occurrences on sites with invasive plants:

Perennial sow-thistle	45%
Canada thistle	31%
Scentless chamomile	9%
Tall buttercup	6%
Common tansy	4%
Ox-eye daisy	2%
Nodding thistle	2%
Cleavers	<1%
Common toadflax	<1%
Field bindweed	<1%

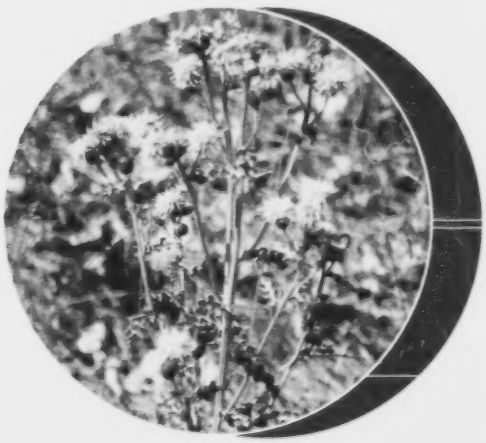
Frequency of degree of infestations on sites with invasive plants:

Trace	35%
Low	53%
Moderate	6%
High	6%

The following table provides information on the 7 sites where herbicide was applied in 2007:

Latitude	Longitude	Species	Degree of infestation
53 53.578	114 53.919	Canada thistle	Moderate 5-25% cover, less than 1 ha
54 15.216	115 15.788	Canada thistle	Moderate 5-25% cover, less than 1 ha
		Perennial sow-thistle	Trace less than 5%, less than 1 ha
53 59.621	114 12.023	Common tansy	Moderate 5-25% cover, less than 1 ha
		Canada thistle	Low about 5% cover, less than 1 ha
54 04.771	114 15.591	Canada thistle	Moderate 5-25% cover, less than 1 ha
		Perennial sow-thistle	Low about 5% cover, less than 1 ha
54 00.809	114 48.677	Canada Thistle	Moderate 5-25% cover, less than 1 ha
		Scentless chamomile	Low about 5% cover, less than 1 ha
53 53.854	114 12.047	Canada thistle	Moderate 5-25% cover, less than 1 ha
		Perennial sow-thistle	Low about 5% cover, less than 1 ha
		Common tansy	Moderate 5-25% cover, less than 1 ha
54 19.217	114 44.361	Canada thistle	Moderate 5-25% cover, less than 1 ha
		Common tansy	Low about 5% cover, less than 1 ha

August 10th was spent with the Junior Forest Rangers at the Lose Gun Recreational Area in Fox Creek. At this location there was an abundance of Canada thistle as well as perennial sow-thistle. The group was split into two crews and one crew pulled weeds by the shoreline while the other crew pulled weeds around the camping areas. Fifteen garbage bags of weeds were then transported to the burner located at Mostowich Lumber.



Canada thistle

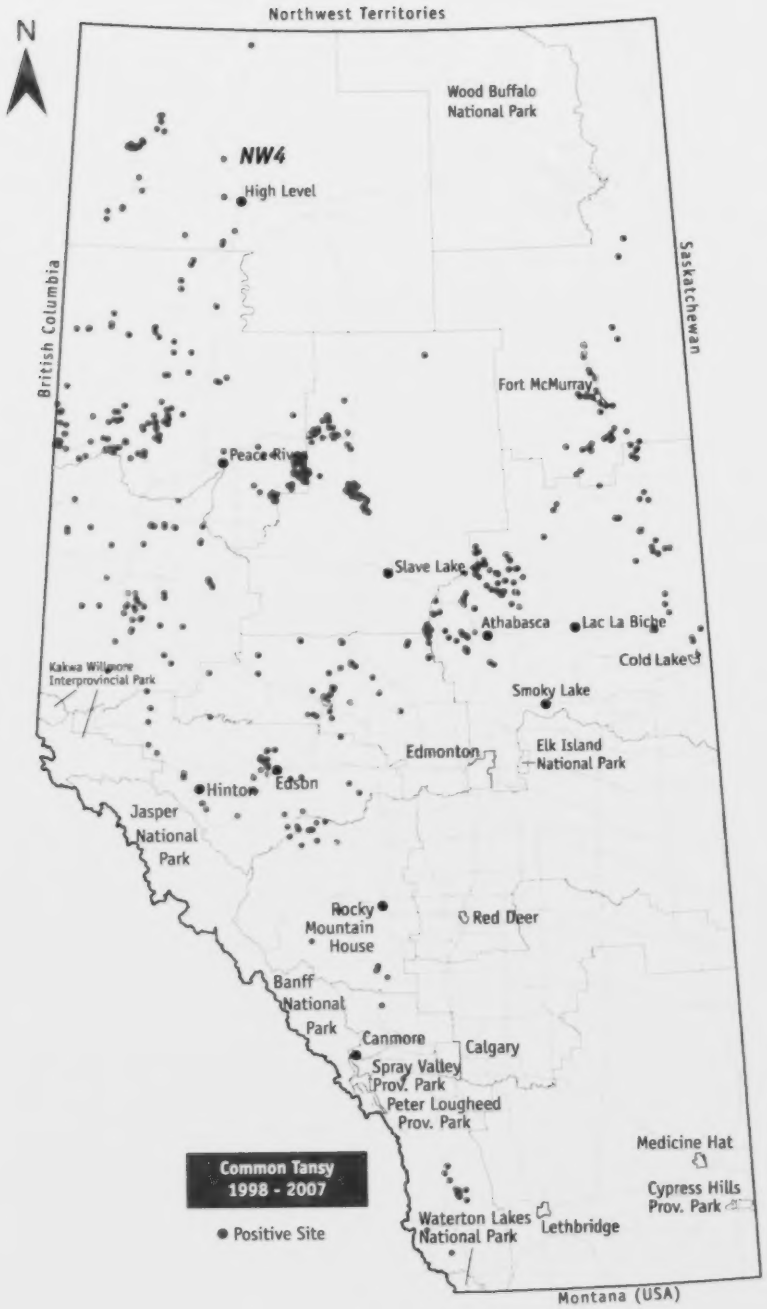


Figure 13
Distribution of Common Tansy in Alberta, 1998 – 2007.

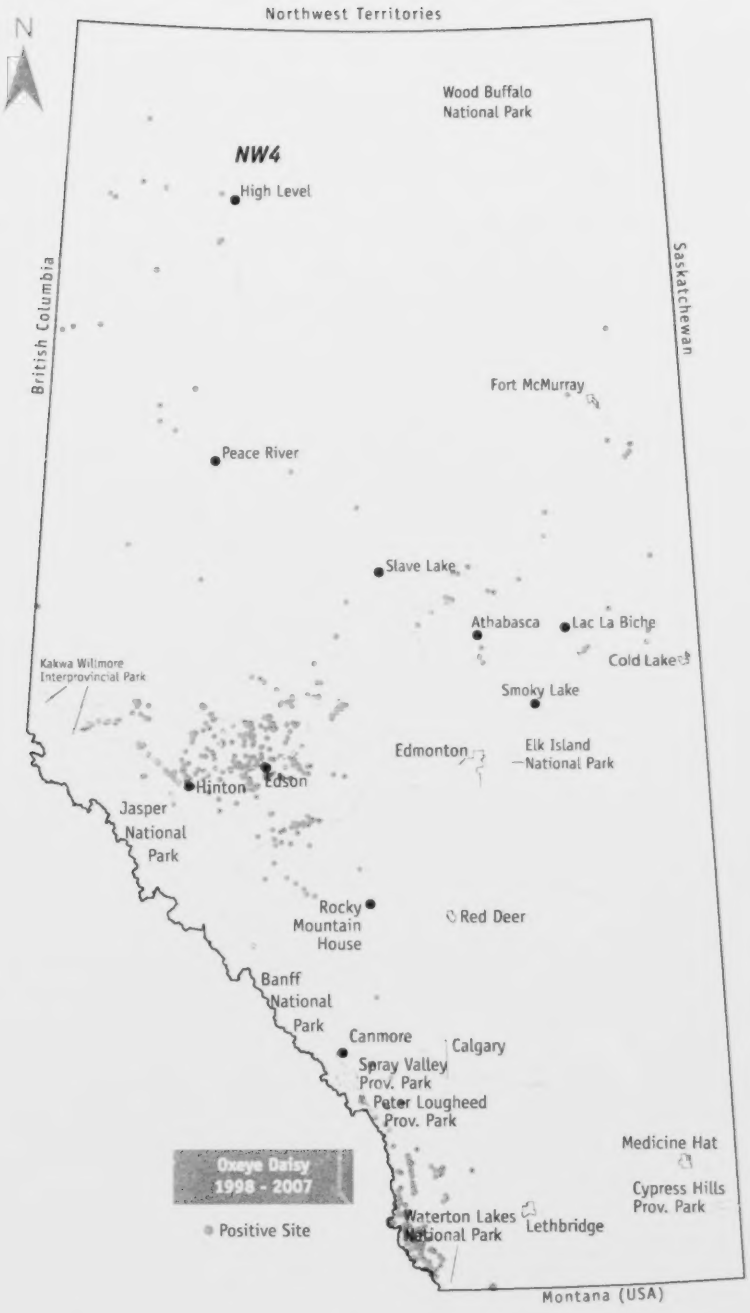


Figure 14
Distribution of Oxeye Daisy in Alberta, 1998 – 2007.

Figure 15
Distribution of Scentless Chamomile in Alberta, 1998 – 2007.

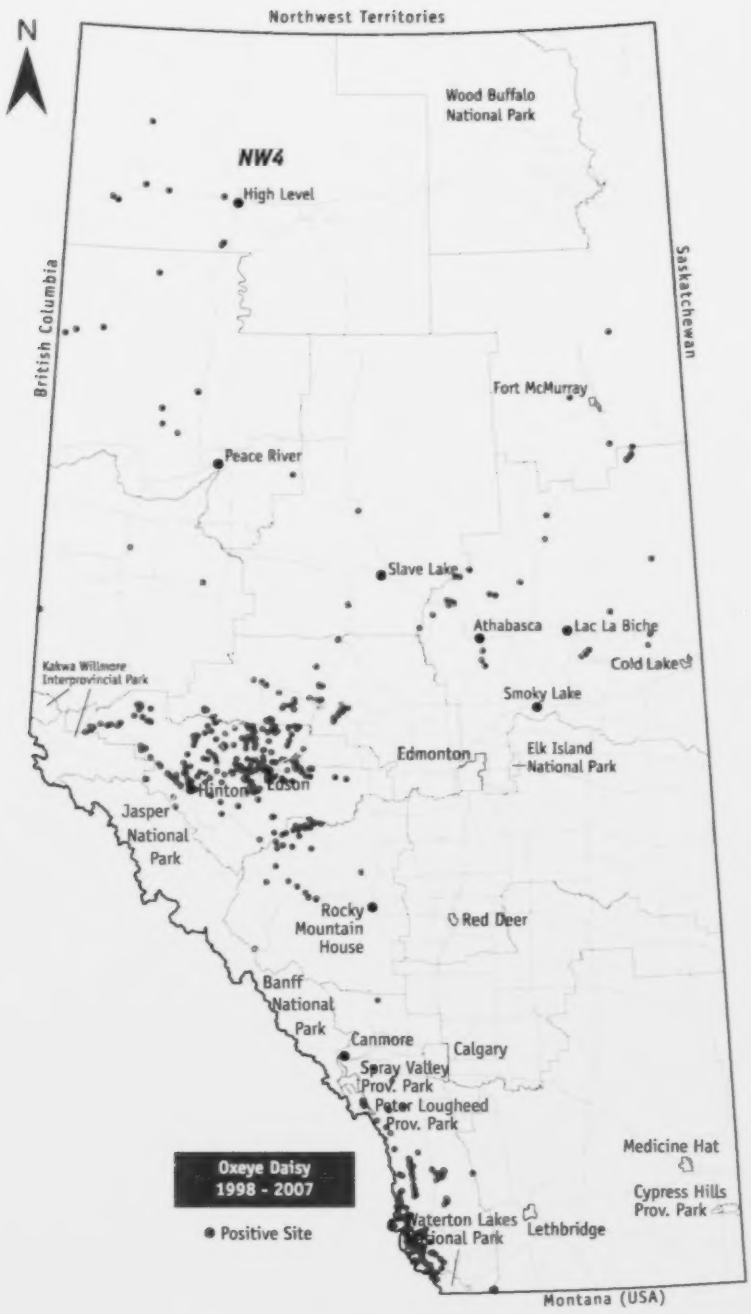


Figure 14
Distribution of Oxeye Daisy in Alberta, 1998 – 2007.

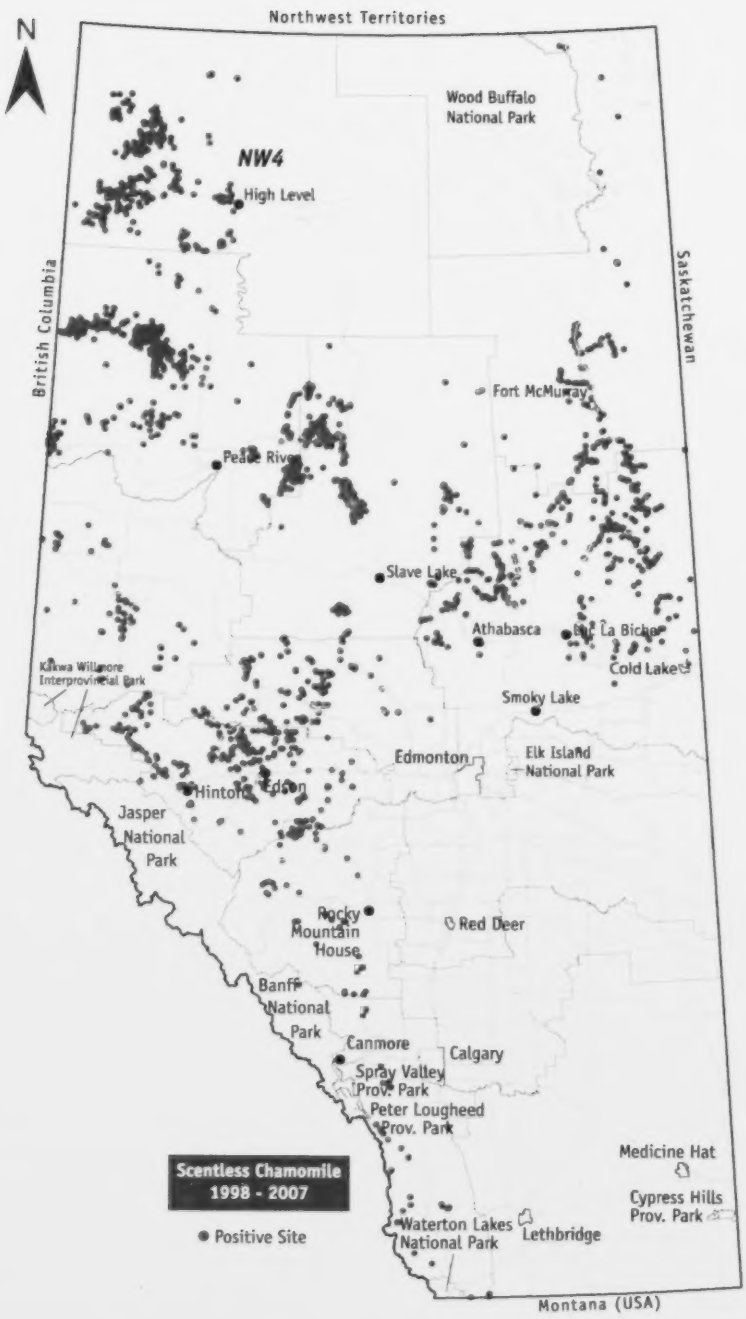


Figure 15
Distribution of Scentless Chamomile in Alberta, 1998 – 2007.

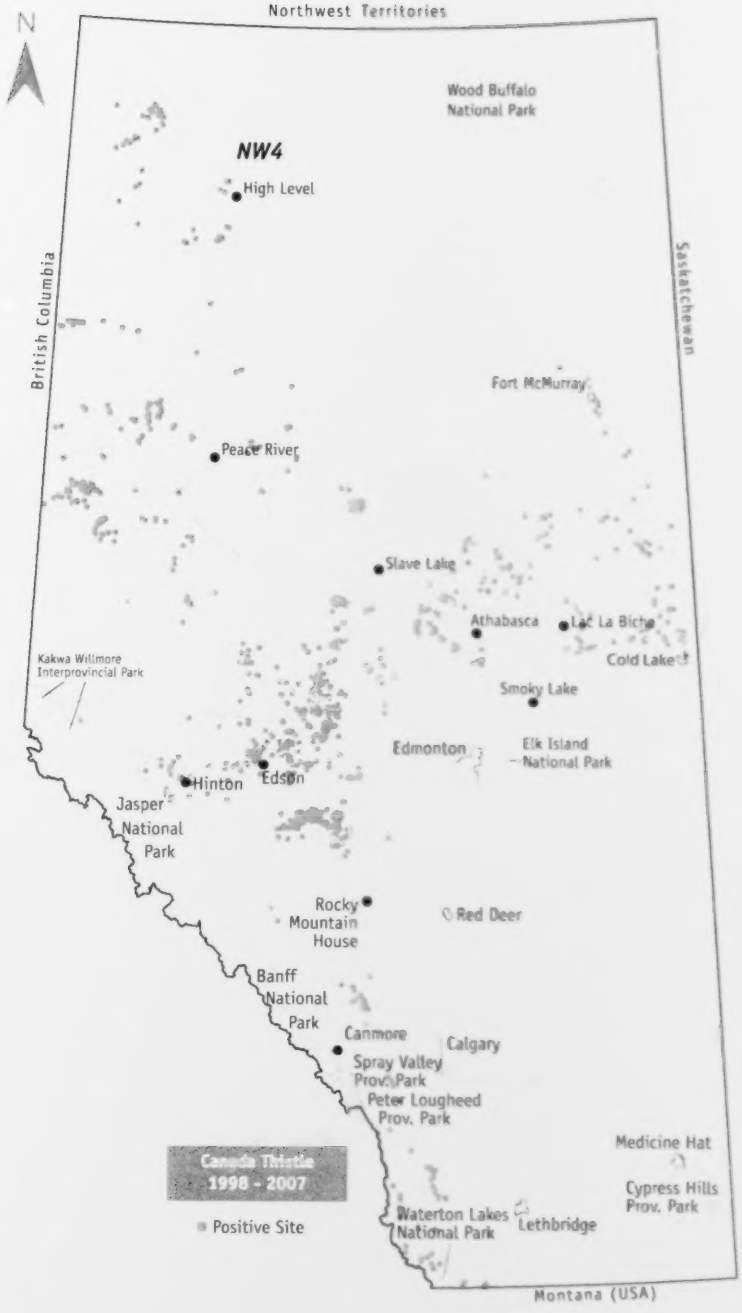


Figure 16
Distribution of Canada Thistle in Alberta, 1998 – 2007.

Figure 17
Distribution of Perennial Sow-Thistle in Alberta, 1998 – 2007.

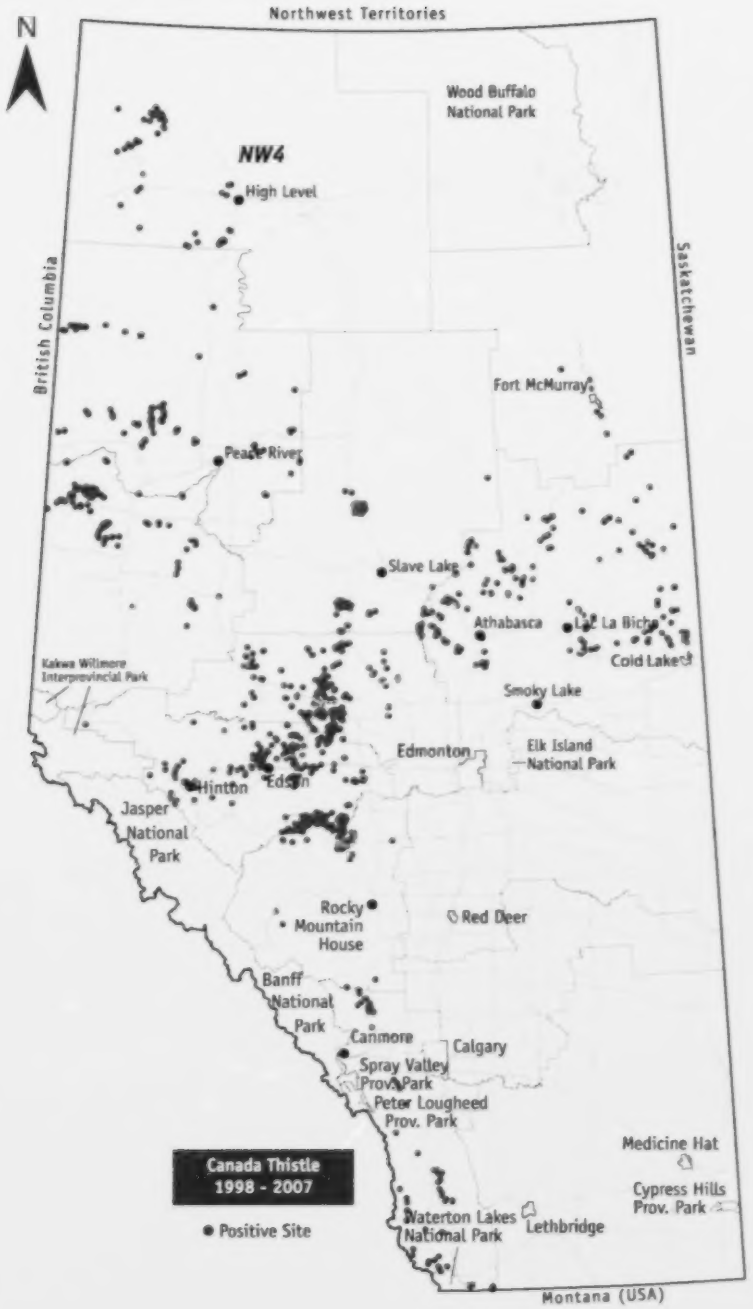


Figure 16
Distribution of Canada Thistle in Alberta, 1998 – 2007.

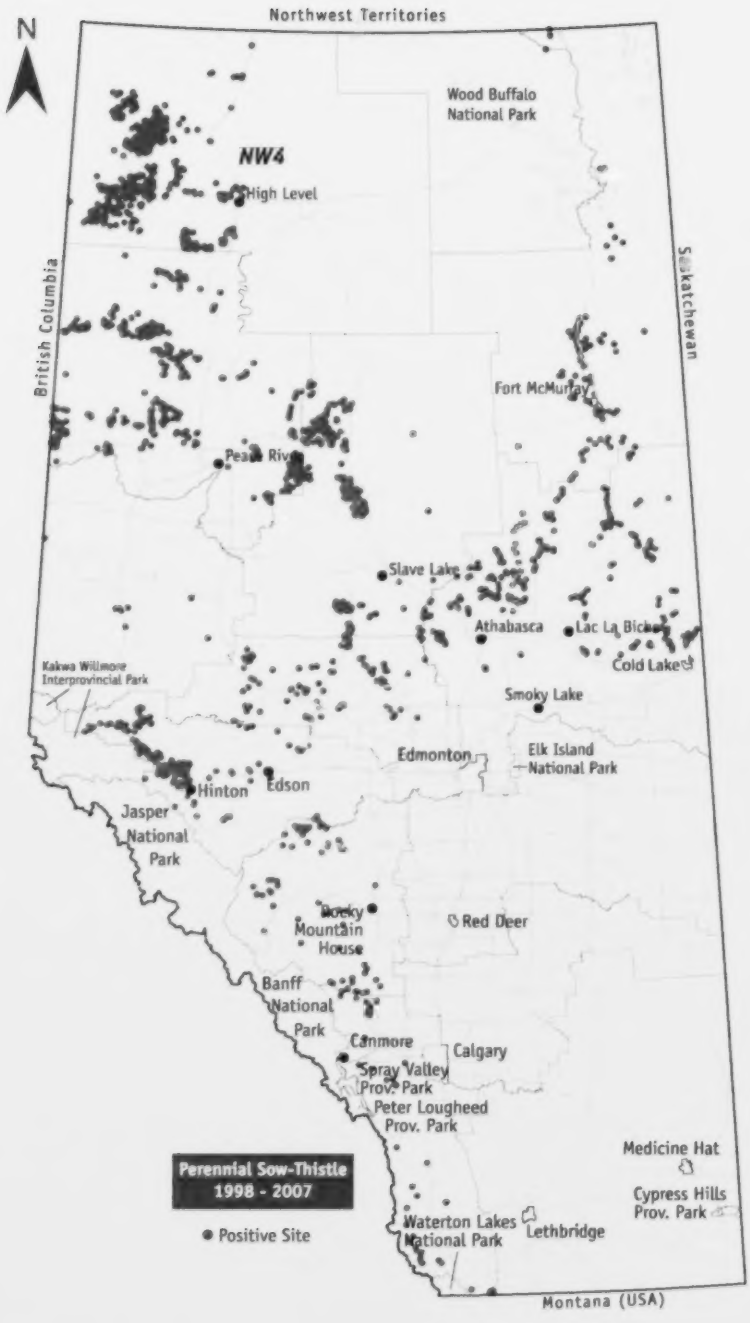


Figure 17
Distribution of Perennial Sow-Thistle in Alberta, 1998 – 2007.

Figure 18
Distribution of Tall Buttercup in Alberta, 1998 – 2007.

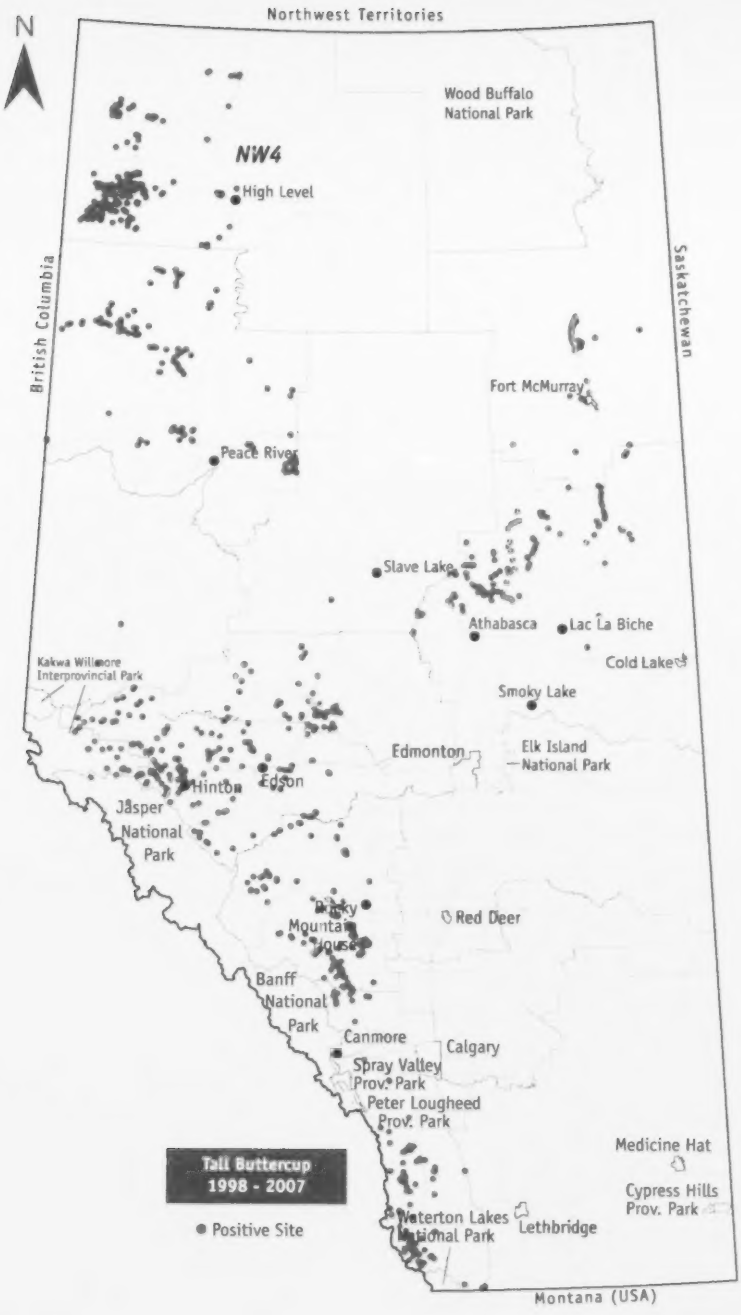
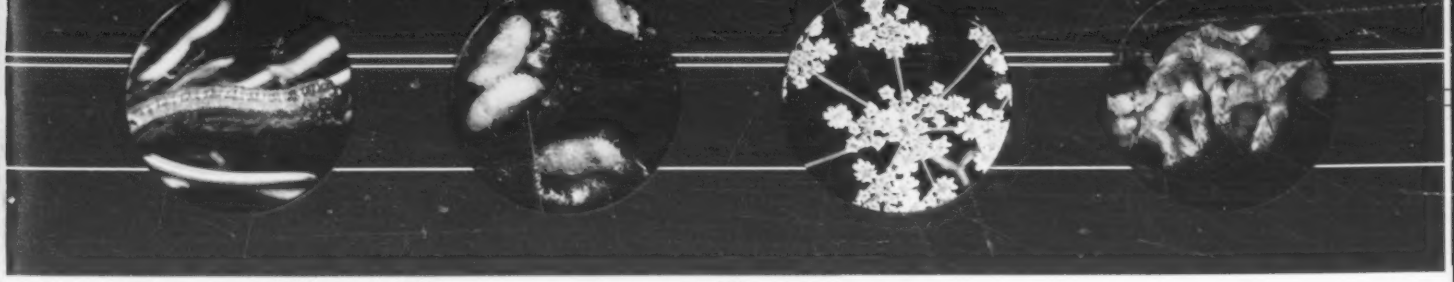


Figure 18
Distribution of Tall Buttercup in Alberta, 1998 – 2007.



Forest Pest Management Programs

Mountain Pine Beetle Management

The estimated number of MPB infested trees in the province has steadily increased in the past few years (Figure 7). The number of infested trees in the province rose dramatically in the 2006/2007 beetle year due to a large influx of MPB from British Columbia to Alberta in July 2006. Alberta Sustainable Resource Development developed an Action Plan and set priorities for managing these infestations.

The MPB Control Program has two prime objectives:

1. To contain infestations and minimize the spread of the MPB north and south along the eastern slopes of Alberta.
2. To prevent the spread of MPB eastward into the boreal forest areas of lodgepole-jack pine hybrids and jack pine.

The main goal of this program is to maintain sustainability of Alberta's pine forests. The expected outcomes of this program included:

- Minimal MPB impact on watershed areas supplying water for major cities and prairie communities, to maintain quality and quantity of water flow;
- Protection of forest fibre resources in Alberta, to maintain long-term sustainable fibre supply;
- Protect high value areas such as genetics and tree improvement seed orchards and field trials, so that these sites can maintain their values for future years;
- Maintenance of a MPB-free buffer along the eastern edge of boreal jack pine forest adjacent to Saskatchewan, to reduce risk of eastward spread; and
- Conservation of pine forest ecosystems of special importance such as the stands of whitebark pine and limber pine.

MPB Detection Program

MPB presence was detected and monitored through survey programs involving aerial and ground surveys to assess beetle risk. Heli-GPS surveys were conducted in areas where MPBs were present in the previous year and infested trees were observable from the air. Some infested trees resulted from long-range dispersal events in the summer 2006 in northern and eastern Alberta could not be surveyed from the air until these trees became faders in 2007. A hotline was established for the general public to report infested trees to determine the extent of the infestation in areas where aerial surveys were not possible. SRD also conducted preliminary walk through detection surveys in highly susceptible stands to identify areas with MPB presence. In 2007 aggregation pheromones were used as baits to detect how far the beetles dispersed. Interception traps were mounted on fire lookouts in an attempt to detect long-range dispersal events over the Rocky Mountains.

Reports from the public and other stakeholders

In Woodlands, Lesser Slave, Smoky and Peace Areas where MPB attacks were detected for the first time in 2006, the infested trees all had green foliage and could not be detected from the air. To determine the extent of the infestation, a "beetle-hotline" (310-BUGS) was established for the general public, workers of the oil and gas sector and forest industry to report infested trees. Pamphlets describing the symptoms of MPB attack and advertising the 310-BUGS hotline were mailed to many municipalities across the province, which distributed them to residents in their communities. News broadcasts on television and radio informed the general public about the MPB infestation and encouraged them to report infested trees through the hotline. In addition, a series of open houses, public information sessions and information booths were held in all Forest Areas, providing information on MPB, SRD's Management Plan and promoting the 310-BUGS hotline.

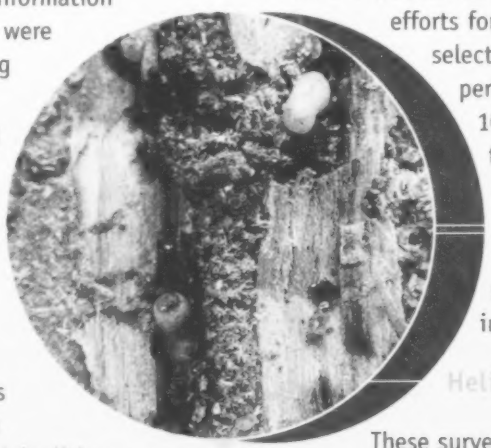
Local Forest Health staff followed up on the calls that reported possible MPB infestations on Crown land. Reports through 310-BUGS of infested trees on municipal lands were forwarded to the respective Municipalities for follow up. Municipalities received grants to conduct surveys and control infested trees on municipal lands through the Municipal Grant Program.

Walk Through Detection Surveys

Walk through detection surveys provide a general overview of MPB presence and infestation intensity in a stand in a relatively short period of time. The survey covered ten to twenty-five percent of the stand area. If MPB were detected this way, the stand was surveyed in greater detail with concentric or transect procedures.

FHOs targeted stands with high susceptibility and further prioritized these by their connectivity to other susceptible stands. Stand susceptibility was identified using the stand characteristics used in the original Stand Susceptibility Index (Shore & Safranyik, 1992) combined with the Climatic Suitability Factor (Carroll et al., 2004). The resulting susceptibility model generated a probability for a stand to produce a successful beetle population in one year if it were infested.

In the Lesser Slave Area, stand susceptibility data were not available during the early stages and surveys simply targeted pure pine stands. Later, once the data was available four to five stands were selected per township, based on the moderate and higher stand susceptibility ratings.



In the Woodlands Area Seena Handel optimized efforts for good spatial coverage by selecting two highly susceptible stands per township. If MPB were detected, 10 more stands were checked in the same township. If MPB was confirmed in all 12 stands of the township, detailed transect surveys were completed in all stands with a stand susceptibility index of 30 or more.

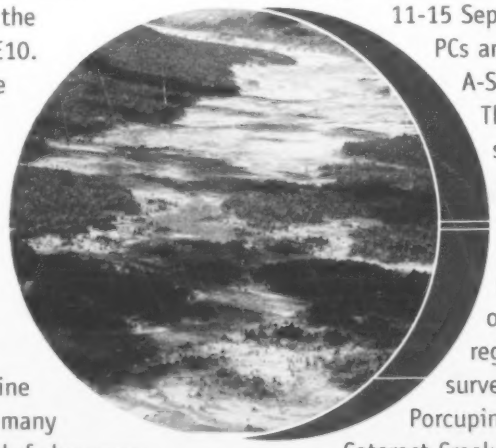
Heli-GPS Surveys

These surveys are carried out in late summer or early fall to detect and record locations of faders that resulted from MPB infestation in the previous year. The procedures for these surveys are described in the MPB Heli-GPS Manual (Anon. 2007). Generally, patches with three or more faders were recorded. However, in areas where trees were scattered and clusters of more than one tree were rare, the Forest Health Officers also recorded GPS coordinates of individual fading trees. The results of these surveys are shown in Figure 9. The survey data were used to plan MPB control action.

Foothills Area

The FHOs Brooks Horne, Erica Lee, Seena Handel, Tom Hutchison and the Forest Health Technician Warren Oates carried out Heli-GPS surveys from August 30 to September 8, 2006. They flew for 68 hours in an A-Star helicopter and recorded location of infested trees using a Tablet PC or a 076CS Garmin handheld GPS unit. Some data was recorded on a 1:75,000 scale map.

The surveyors detected infested trees in Willmore Wilderness Park and in the Forest Management Unit (FMU) E10. Faders were detected west of the Muddywater and Smoky River confluence with increasing infestation severity towards the Alberta/British Columbia border. Moderate infestation was recorded along the Sheep River; Muddywater River, Fetherstonhough River; Pauline River and the Jackpine and Pauline river confluence. In these areas many green attacks not associated with faders were found indicating immigration of MPB into these areas. Stressed trees around the perimeter of Edson Wildfires 173 and 109 were heavily hit by MPB. There were indications throughout the infestation that MPBs followed a two-year cycle and there were also signs of multi-year attacks.



Smoky Area

Mike Maximchuk (Forest Health Officer) and Natalie Henneberry (Forest Health Technician) conducted aerial overview surveys on 17-20 July 2006, followed by heli-GPS surveys on 11-16 September 2006. Using a tablet PC in an A-star B2 helicopter they flew a regular grid pattern to detect red or fading trees. They marked 276 trees as possible MPB attacks during the overview survey and detected an additional 808 trees during the heli-GPS survey. All trees detected were located south of Grande Prairie and west of Highway 40. The majority of the trees detected with discolouration were located in close proximity to the BC border in the Narraway River and Kakwa Park areas.

Southern Rockies Area

Bart McAnally (Forest Health Technician), Rupert Hewison (Forest Health Technician) and a contractor conducted aerial overview surveys and heli-GPS surveys in the Southern Rockies Area on 4-8 and 11-15 September 2006. They used tablet PCs and Bluetooth GPS equipment in A-Star B2 and Bell 407 helicopters. The overview and detailed Heli-GPS surveys covered approximately 85% of susceptible stands in the Southern Rockies Area. Outside of known infestation areas the surveyors conducted aerial overview surveys by flying in a regular grid pattern. The overview surveys covered Castle River, Porcupine Hills, Bob Creek Wildland, Cataract Creek, Highwood and Lake Minnewanka. Ground truthing of approximately 30 sites in these areas outside of the known infestations revealed that the discolouration of the foliage detected from the air was not due to MPB attack.

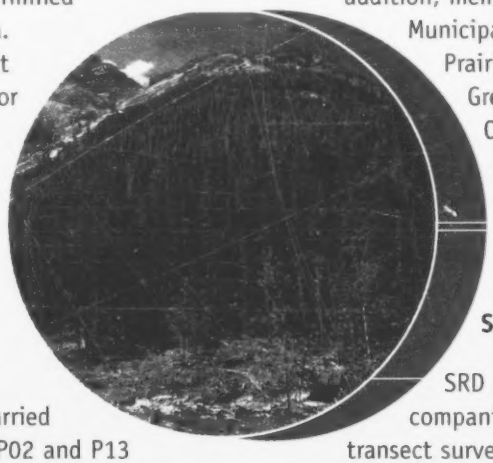
Bow Valley, Spray Lakes, Peter Lougheed Provincial Park, Oldman, Dutch Creek, Crowsnest Pass and Tent Mountain were surveyed in detail with heli-GPS surveys. The surveyors flew in a zig-zag pattern in the tight mountain valleys of these areas. They recorded detailed GPS locations of 1480 red tree sites. Ground surveys confirmed that MPB was the cause of mortality at 788 of these sites. The main areas identified as infested with MPB were the valley along highway 1 near Canmore; areas around the Spray Lakes reservoir; near Kananaskis Lakes in Peter Lougheed Provincial Park; along the Oldman River, Dutch Creek and the Dutch Creek Road; the Crownest Pass and south of the Crowsnest Pass.

Peace, Upper Hay, Woodlands and Lesser Slave Areas

No aerial surveys were conducted in Peace, Upper Hay, Woodlands and Lesser Slave Areas in 2006, the first year that MPB presence was recorded in these areas. All infested trees were in the green-attack stage, rendering detection from the air impossible. Hence, walk-through-detection surveys were conducted on the ground in stands with high susceptibility to MPB infestation.

Detailed Ground Surveys

After the aerial surveys or walk through detection surveys, ground surveys are carried out to detect and record individual trees containing living MPB brood. These trees usually have green foliage and are therefore not observable from the air. Transect surveys and concentric surveys are carried out in areas where aerial overview surveys have shown faders or where walk through surveys detected the presence of green attacks. Transect surveys are systematic surveys carried out to identify 100% of the infested trees along pre-determined transect lines in an infested area. Concentric surveys are carried out when faders are few, spread out or at locations with limited access. The procedures for these surveys are described in the procedure manual entitled Mountain Pine Beetle Detection and Management in Alberta.



Peace and Upper Hay Areas

SRD staff and four contractors carried out ground surveys in the FMUs P02 and P13 in the Peace and Upper Hay Area between October 17, 2006 and May 4, 2007. Most of these were transect surveys. A total of 37,365 infested trees were detected. SRD crews also carried out ground surveys throughout the fall and winter in P3, P4, P5 P8, P15 and P16 Forest Management Units (FMU) in an effort to find the extent of the 2006 beetle flight

Foothills Area

SRD crews and contractor crews carried out ground surveys between October 4, 2006 and June 3, 2007. These included concentric, transect, walk through detection and modified burn-edge transect surveys. The crews surveyed Willmore Wilderness Park and the FMUs E8 and E10. They detected 40,028 infested trees.

Smoky Area

Starting on 20 August 2006 until the spring in 2007 SRD staff and contractors surveyed across the entire Smoky Area with particular focus on Weyerhaeuser and Canfor Forest Management Agreement Areas and Crown lands embedded in the White Zone. Using concentric and transect procedures, red tree locations were inspected for presence of MPB and searched for new green attacks. Highly susceptible stands were also searched for the presence of MPB due to the large MPB immigration event that occurred in 2006 summer. A total of 20,061 green attack trees were confirmed on Crown land during these surveys. In addition, members of the South Peace Municipality group (Counties of Grande Prairie, Saddle Hills, Birch Hills, Greenview, Spirit River) and the City of Grande Prairie conducted ground surveys for MPB infested trees on municipal land and private land where reports from private landowners occurred.

Southern Rockies Area

SRD crews and four contract companies conducted concentric and transect surveys on crown land, provincial parks and protected areas in Southern Rockies from October 2006 until July 15, 2007. These surveys revealed 9,945 infested trees of which 7,257 were found in Kananaskis Country, with a particularly high density in the Spray Lakes infestation, and 2,688 infested trees were found in the Crowsnest area. In

addition, the Municipality of Crownest Pass, Municipal District of Bighorn and the Town of Canmore surveyed municipal and private land for MPB.

Woodlands Area

Ground Surveys commenced early October 2006 and were completed by the time the beetles flew in July 2007. Walk through detection surveys were used heavily as all the trees attacked in the August 2006 flight had not yet faded to red and there were no aerial survey points collected. Stands to be surveyed were identified through a Stand Susceptibility Rating Model so that efforts were focussed on the highly susceptible stands. SRD staff and contractors covered over 30,000 ha of working forest on Crown land and identified 724 infested trees. Quality Inspection was conducted on approximately 10% of walk through detection sites. In addition, First Nations performed similar surveys on the Reserves.

Lesser Slave Area

Initial walk through detection surveys of stands with high susceptibility index (SSI) were conducted by SRD staff in the winter of 2006/07 to determine presence of MPB in Lesser Slave Area. Once presence was confirmed, transect surveys were completed by contractors. The surveys covered Crown land and Winagami Wildland Park. At the 414 sites surveyed, 399 trees were identified as infested with MPB. These trees were in the first year of attack so no green/red ratios could be determined. The majority of infested trees were in the south-western corner of the Area.

Waterways and Lac La Biche Areas

SRD staff conducted walk through detection surveys from 20 March 2006 to 30 September 2007 in highly susceptible pine stands on Crown land. Primary areas of interest were stands in the vicinity of Smith and particularly those near the CFS funnel trap site where MPB had been captured in August. Stands near the hamlets of Flatbush and Fawcett were also surveyed. Additionally, stands around all genetic and tree improvement sites in the Waterways and Lac La Biche Areas were assessed. No MPB attacked trees were found in the surveyed stands.

Long Distance Dispersal Monitoring

Due to the large MPB population currently in central and northern British Columbia, it is possible for long-distance dispersal event to recur. Early detection of such a flight will facilitate developing operating procedures and priority setting. SRD is in close contact with the British Columbia Ministry of Forests and Range, who are monitoring beetle emergence and peak flights, to share their findings with Alberta.

Dispersal Baits

Strategic deployment of pheromone baits over large areas aids the detection of a long distance dispersal event. Monitoring sites were set up in 2006 by SRD in Willmore Wilderness Park, E8, E7 FMUs and by Hinton Wood Products (West Fraser Mills) on the Forest Management Agreement Area. Eighty-seven sites were baited with an aggregation pheromone (Phero Tech Inc., BC). At each site, baits were deployed on three trees located 50 metres from each other in a triangle in a susceptible pine stand. There was one site per township. The pheromone baits were deployed from July 5-15 prior to MPB flight. The baited sites were checked and baits were removed between 15–25 September. Baited trees at 16 sites had hits varying from 1-45 per tree. There were no spill-over attacks. The attacked trees were treated to remove the beetles.

The dispersal bait sites in the Foothills Area were successful in determining the southern extent of the dispersal flight from British Columbia in 2006. The program was expanded in 2007. A total of 603 bait sites were set up in townships throughout the areas that could be affected by a large flight (Table 8, Figure 19). The sites were monitored during the MPB flight period. At least 50% of the bait sites throughout the entire baited area were visited between August 1st and 9th. Final checks were conducted in September 2007.

Table 8
Number of mountain pine beetle dispersal bait[1] sites per Area in Alberta.

Area	No. of sites baited
Peace	41
Foothills	177
Lesser Slave	38
Waterways/Lac La Biche	43
Woodlands	81
Southern Rockies	76
Clearwater	147
Total	**603**

[1] Baits were deployed in May – July 2007.

Figure 19 shows that the furthest east the MPBs travelled in 2007 was the Lesser Slave Area. None of the baited sites in the Lac La Biche Area were attacked. In the Peace Area, beetles attacked baited trees in the northern most region where the baits had been deployed. In the Woodlands and Foothills Areas the beetles appeared to have reached only the western regions. In the Clearwater Area, the attacked trees were close to the boarder of Banff National Park where MPB presence has been known for some time. In the Southern Rockies Area attacked trees occurred almost throughout the range of baited sites.

In addition to the dispersal bait sites, SRD staff of the Waterways and Lac La Biche Area monitored two Canadian Forest Service Lindgren funnel trap sites. One set was located near Round Hill Tower north of Lac La Biche, and another set just west of the Athabasca River, near the hamlet of Smith. Two adult beetles were captured at the site near Smith in mid-August. They were positively identified as MPB by Darryl Williams (Forest Health Technician, Northern Forestry Centre, Canadian Forest Service) in November 2007. However, no attacked trees were found.

Figure 19
Locations of baits and results of the MPB dispersal monitoring program in 2007 in Alberta.

Interceptions Traps

Interception traps were set up on fire lookouts in the areas that may be in the path of a dispersal flight from British Columbia (Table 9). As the beetles either fly or become wind-borne they contact these traps and are collected. This will allow SRD to determine if the beetles flew into a certain area and when/if the flight from British Columbia occurred.

Table 9
MPB catches in interception traps mounted on fire lookout towers in Alberta, 2007.

Area	No. of MPB Caught
Smoky	4
Foothills	3
Lesser Slave	6
Lac La Biche	3
Woodlands	3
Southern Rockies	1
Clearwater	2
Total	**23**

The Fire Lookout observers were trained in collection and storage of the specimens. Collections were made daily from July 15 – August 15 2007. Specimens collected each day were placed in individual collection vials. Forest health staff arranged for the weekly collection of the samples and the identification of the specimens. The Lookout observers informed the Area of the status of the interception traps and specimens collected each day.

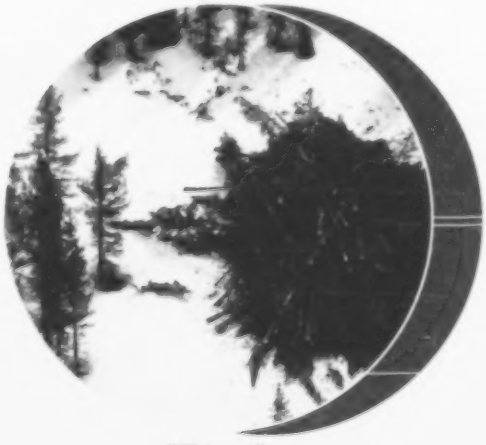
Summer Early Detection Overview Surveys (SEDOS)

The FHOs in a few Areas carried out SEDOS in June 2007 to detect early faders. SEDOS can only be carried out where trees were attacked by the MPB in the previous year. They commence with the appearance of early faders and ending shortly before the onset of next MPB flight in the summer. During this survey locations with currently infested early faders are digitally recorded along with the estimated percent of trees attacked. These results were used to plan a baiting program so that live MPBs in trees that could not be controlled before beetle emergence are concentrated over a small area in trees with known locations.

Control Program

Beetle Strategy

This strategy is implemented at two levels. At Response Level I, either single or small groups of infested trees are removed and treated to destroy the beetles. Onsite debarking, burning or grinding the boles are the treatments used to destroy MPB in these trees. Alternatively, they can be transported off-site for treatment through heli-assist operations. This may be the only strategy used in ecologically sensitive areas. Table 10 provides a provincial overview of the Level I operations conducted in the 2006/2007 beetle year.



MPB burn pile

Table 10
Number of MPB-infested trees detected and controlled with single-tree treatments in Alberta during the 2006/2007 beetle year.

Area	infested trees detected	Infested trees controlled
Southern Rockies	9,945	9,469
Foothills	40,028	35,363
Woodlands	724	443
Lesser Slave	399	218
Smoky	20,061	8,316
Peace	37,208	35,895
Provincial Total	**108,365**	**89,704**

Sites with infested trees that were not controlled before the beetle flight in 2007 were baited with aggregation pheromones in order to concentrate the emerging beetles into small areas. New patches of fading and red trees identified during SEDOS were also baited to limit the spread of emerging beetles. All the patches with 3 or more fading trees within the leading edge were baited. If time permitted, single and double trees also were baited. Large patches of fading trees in other areas were baited if it aided in reducing beetle spread. All SRD deployed bait information was stored in the Mountain Pine Beetle Database in the FIRES system. The baited trees were to be surveyed after the flight and controlled if they were infested.

At Level II Response, infested trees are harvested and processed. Table 11 shows the companies that applied for dues relief for harvesting infested wood as Level II response. A total of 815,869 cubic metres of wood were harvested from infested stands and claimed for dues relief in Alberta during beetle year 2006.

Table 11
Volume of wood hauled from mountain pine beetle infested stands under Response Level II during the beetle year 2006/2007 in Alberta.

Company	Volume (m^3)
Canfor	83,026
Alberta Plywood	118
Blueridge	33,211
Weyerhauser Grande Prairie	668,624
Mostowich	7,918
Charles Blake	3,310
Ainsworth	1,874
Jess Peachy	1,970
Colin Ruxton	8,673
David Peachy	4,886
Lonepine Holdings	2,259
Total	**815,869**

The Mountain Pine Beetle Log Management Directive sets out procedures for Level II Response that aims to protect Alberta's forest resource from spreading MPBs. The directive specifies procedures for hauling, storage, transfer, manufacturing/processing, residue disposal, scaling and harvest accounting, record keeping, compliance and enforcement, and pheromone monitoring at manufacturing and processing sites of Level II harvested pine with bark attached. Further details on the directive can be found online (http://www.srd.gov.ab.ca/forests/pdf/MPB%20Log%20Management%20Directive%202006-05.pdf). Companies can apply for reimbursement of the cost for some of the activities outlined in the required procedures through the Forest Resource Improvement Association of Alberta (FRIAA) program outlined in the FRIAA MPB Program in this report. Information on log yard management standards for which FRIAA funding is available can be found online www.srd.alberta.ca/forests/pdf/logyard_management_standards.pdf).

Peace and Upper Hay Areas

In Upper Hay and Peace Areas, SRD crews treated 8,008 trees and heli-assisted contractors removed another 27,887 trees between November 15, 2006 and June 30, 2007. Out of these trees, 30,836 were removed from 186 sites in the FMU P02 and another 5,060 were removed from 117 sites in FMU P13.

Foothills Area

In the Foothills Area, SRD crews and heli-assisted contractors treated 35,363 infested trees. In Willmore Wilderness Park, contractors removed 30,513 trees and SRD crews cut and burned another 3,818 trees on site. Another 82 trees were removed by heli-assist from E10 FMU. An additional 950 trees were cut and burned in the FMUs of E10 (791 trees), E8 (18 trees) and E7 (141 trees). The infested trees that remained untreated were trees that faded early and were detected when control crews were unable to reach the site in time before the flight. Containment baits were put up at these sites to prevent the emerging beetles from spreading in the forest. One pheromone bait was deployed for every five faders at new fader sites seen during Summer Early Detection Overview Surveys. From 1-15 July 2007 SRD crews put up 423 baits in 240 sites in Willmore Wilderness Park and 400 baits in 207 sites in Foothills FMUs. Sites were to be surveyed during the winter of 07/08.

As part of Level II response, Foothills Forest Products harvested one block containing infested trees in February 2007. The block was located east of Grande Cache and was 24 hectares in size.

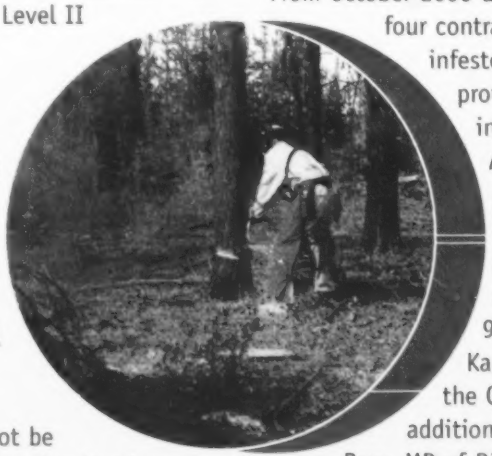
Smoky Area

In the Smoky Area, SRD staff and contractors treated 8,316 infested trees using primarily the fall and burn technique. Mulchers were used in some areas with higher density of infested trees. Adverse weather

conditions, posed operational challenges for controlling the trees that had been detected. Since 2006 was the first year the Smoky Area experienced an MPB epidemic, emphasis was put on identifying the extent of the infestation. The South Peace Municipality group (County of Grande Prairie, Saddle Hills, Birch Hills, Greenview, Spirit River) surveyed and controlled infested trees on private property in the White Zone. The City of Grande Prairie surveyed and controlled infested trees on private and public land in the city limits. Some stands on Canfor's Forest Management Agreement Area were baited and scheduled to be harvested under Level II response the following season.

Woodlands Area

Contract Type 1 Firetack and SRD staff conducted control work in the Crown forest from January until late June 2007. The beetle strategy in the Woodlands Area involved primarily Level I control where 445 trees were cut and burned or peeled. Baits were established on sites that could not be treated in time to contain the emerging beetles. There was a goal of 10% quality inspection implemented on control locations. As part of the Level II control program ANC Timber Ltd. harvested two infested stands. Millar Western Fox Creek Division (formerly Mostowich Lumber) harvested four infested stands in ANC Timber's FMA and one infested stand in Blue Ridge Lumber's FMA. Blue Ridge Lumber Inc. harvested six infested stands in their FMA and two infested stands in ANC Timber's FMA. The harvested wood was processed by 15 June 2007 in accordance with the Logyard Management Directive. Before the beetle flight, the Town of Fox Creek, under the Municipal Grant Program, felled and burnt twelve infested trees within the town limits. In addition to the control efforts conducted by SRD, industry and municipalities, Alexander First Nations surveyed and controlled infested trees on the Reserve.



Lesser Slave Area

In the Lesser Slave Area, 2006 was the first year of recorded MPB presence. The MPB populations detected in the Lesser Slave Area represented the eastern edge of the infestation in Alberta. In the spring and summer of 2007, SRD staff felled and burnt a total of 218 infested trees on Crown land and in Winagami Wildland Park.

Southern Rockies Area

From October 2006 until 18 July 2007 SRD crews and four contract companies controlled 9,469 infested trees on Crown land, provincial parks and protected areas in the Southern Rockies Area. Almost half of these were controlled by felling and burning the trees on site, while the rest were flown off-site during heli-assist operations. Altogether 9,469 trees were removed from Kananaskis Country and 2,596 from the Crowsnest infestation. In addition, the Municipality of Crownest Pass, MD of Bighorn and the Town of Canmore controlled infested trees on municipal and private land.

Forest Resource Improvement Association of Alberta (FRIAA) MPB Program

Funding has been made available through the FRIAA to support tenure holders and mill operators in assisting SRD in monitoring and control of the MPB. Under the FRIAA MPB program industry is reimbursed for doing work that would otherwise be the responsibility of the Province. The program was launched in July 2007. The funds are administered by the FRIAA, which reviews proposals applicants submitted to acquire funding for MPB management projects. Activities related to control and suppress the MPB are eligible under this program if they enhance the forest resource and are not the

responsibility of a timber disposition holder. Activities that are eligible for FRIAA funding include

- the use of aggregation pheromones for long-distance dispersal monitoring, containment baiting, mop-up baiting and log yard management;
- detection surveys including aerial surveys and ground surveys;
- single-tree treatments;
- protection of genetic trials, orchards and research projects with the use of anti-aggregation pheromones (verbenone);
- seed collection and seed orchard expansion.

FRIAA does not approve any proposals that would involve the provision of subsidies to the forest products industry. Details of the program can be viewed online www.friaa.ab.ca/mountainpinebeetle.html.

Municipal Grant Program

Since MPB infestations are a landscape level phenomenon, all affected jurisdictions need to work together for a MPB management program be successful. While SRD implemented aggressive MPB monitoring and control programs on provincial public lands, municipalities were engaged to manage MPB problems on municipal and private lands. Municipalities that were identified by SRD as having active MPB infestations were invited to partner with SRD in addressing the issue. For this purpose SRD allocated funds to aid communities affected by the MPB infestation with managing MPB on their jurisdictions. SRD also performed aerial surveys on these lands in some areas.

Municipalities applied for grants by submitting proposals that outlined their course of action for managing the infestation on municipal lands. In some cases multiple municipalities coordinated their programs and received grants for their entire program (Table 12). A total of 66,659 infested trees were controlled under this program during the 2006/2007 beetle year. Further details of the program can be found in the Mountain Pine Beetle Municipal Grant Funding Program Guidelines on the Forest Health website www.srd.alberta.ca/forests/pdf/2007_MPB_municipality_program_guidelines.pdf).

Table 12
Number of mountain pine beetle infested trees controlled under the municipal grant program in the bettle year 2006/2007 in Alberta.

Area and Municipality	No. of trees controlled
Peace	
Town of Fairview	105
MD of Northern Lights	0
County of Clear Hills	0
Town of Peace River	154
Northern Sunrise County	54
MD of Peace and MD of Fairview	738
Smoky	
South Peace Municipality (Counties of Grande Prairie, Saddle Hills, Birch Hills, Greenview, Spirit River)	63,769
City of Grande Prairie	634
Foothills	
Town of Grande Cache	60
Woodlands	
Woodlands County	0
Town of Fox Creek	12
Southern Rockies	
MD of Bighorn	4
Town of Canmore	156
MD of Crowsnest Pass	973
Total	**66,659**

Prevention Program

Reduction of Pine Stands with High MPB Susceptibility

Under the Healthy Pine Strategy, SRD is committed to reducing the amount of pine susceptible to the MPB to reduce the risk of potential environmental, social and economic impacts of future outbreaks. Susceptibility of stands to MPB attack is rated based on the stand characteristics used in the original Stand Susceptibility Index (Shore & Safranyik, 1992) combined with the Climatic Suitability Factor (Carroll, 2004). The resulting susceptibility model generates a probability for a stand to produce a successful beetle population in one year if it were infested.

Stands with high ratings are to be preferentially harvested over stands with low susceptibility ratings. Forest Management Agreement (FMA) holders are directed to amend their current management plans to reduce the amount of susceptible pine on their operating landbase to 25% of the anticipated level, over 20 years. This action changes stand age-class structure over the landscape thus enhancing resistance to MPB attack and spread (ASRD 2007).

Prescribed burns are another tool SRD aims to implement to reduce the amount of highly susceptible stands where the climate is favourable for MPB population expansion. Although planned, no burns have been carried out so far as unfavourable weather conditions rendered such action unfeasible or unsafe. Nevertheless, SRD will continue to attempt conducting prescribed burns for reducing the amount of pine susceptible to the MPB.

Use of Verbenone

Brooks Horne (Forest Health Officer) used pouches with Verbenone, an anti-aggregation pheromone, to prevent MPB attacks on cone-bearing whitebark pine in the Fetherstonhaugh Creek and Mount Sprague areas of Willmore Wilderness Park. His staff hung 275 pheromone pouches containing Verbenone on the trunks of all cone-bearing whitebark pines within a 7.5 hectare area with mixed pines. Pheromone pouches were not deployed on the lodgepole pines in this area.

Out of the 275 whitebark pines in this area, 19 (6.9%) treated trees were attacked by the MPB. In comparison, 31 out of 128 (24%) of untreated lodgepole pines were attacked. The beetles in the attacked whitebark pines had an R-value (an indicator of population increase) of >4 indicating a high risk of beetle expansion. Overall, the R-value of beetles in the lodgepole pines was 2-4, indicating a moderate risk of expansion. The results indicated that Verbenone pouches provide partial protection from MPB attacks under these population levels. It would be interesting to test effectiveness of Verbenone pouches under different MPB population levels.

In the Smoky Area, high value trees at Kakwa Falls and around Grande Prairie as well as some northern white bark pine stands were treated with Verbenone. The South Peace Municipality (Counties of Grande Prairie, Saddle Hills, Birch Hills, Greenview, Spirit River) also used a "push-pull strategy" by deploying aggregation baits to attack trees slated for removal combined with anti-aggregation pheromones (verbenone) on trees to be protected in the Iroquios area and in areas directly south of Grande Prairie.

Protection of High Value Seed Orchards and Genetic Sites

SRD has several genetic sites and seed orchards scattered throughout the province. These sites are highly valuable and are intensively managed. In an effort to protect these sites, 50 metre-wide area surrounding each of these sites was surveyed for beetle attack. If any trees within this 50-metre area were attacked, those were cut and burned before beetle flight.

In addition to survey and control outside of these sites, SRD Genetics and Tree Improvement staff will monitor trees within the sites. Some sites were

protected with the use of anti-aggregation pheromone Verbenone and contact insecticide Carbaryl ® sprayed over the stem.

Regulations to prevent infestation spread

The Mountain Pine Beetle Log Management Directive regulates all timber transported on public highways that was harvested from private and federal land in Alberta. It restricts the transportation of such infested wood with bark attached to the period between October 1 of the current year and June 15 of the following year. The directive came into effect on November 27, 2006 and is available online at: www.srd.alberta.ca/forests/pdf/MPB%20Log%20Management%20Directive%202006-05.pdf.

Another directive came into effect on November 28, 2006 to protect Alberta's forests and economy from destructive forest pests that can be unknowingly introduced with shipments of imported coniferous logs and forest products with bark attached. The directive stipulates that the Minister's approval is required to import such materials into Alberta. The Minister may withhold his approval, or restrict or prohibit transportation of such material within Alberta if the importation could cause or increase the damage to forest growth by insects or diseases. This directive thereby prevents human transportation of MPBs into Alberta from source populations in British Columbia and the USA. Coniferous forest products regulated by this directive include logs, cants, rough-sawed lumber, slabs, roundwood, hoopwood, split poles, pickets, stakes, staves, squared timber, lath, butts, tops and firewood of any conifer species, with >2% outer-bark attached; and shipments of hog fuel or any other wood residue or debris, containing >2% conifer bark by mass. The directive can be accessed online www.srd.alberta.ca/forests/pdf/Importation%20Directive%20Nov%202006.pdf).

Spread Control Overhead Team

The Canada-British Columbia (BC) Implementation Strategy – Mountain Pine Beetle Emergency Response (ERS) was established in September, 2005. The overall goal of this strategy is to minimize the spread of MPBs from BC into Alberta and the boreal forest. Four BC Ministry of Forests and Range Districts (Rocky Mountain, Columbia Forest, Headwaters and Peace Forest Districts) have assumed responsibility for bark beetle suppression along the BC-Alberta provincial boundary in part to complement suppression treatments conducted by SRD, BC Parks and Parks Canada.

The Spread Control Overview Team (SCOT) was created to develop a system to oversee the operational and tactical plans for MPB spread control activities that will be undertaken in the BC districts bordering Alberta. The team consists of entomologists and managers of the BC Ministry of Forest and Range, SRD, Canadian Forest Service, Parks Canada, an independent consultant, and a conservation analyst from the Ministry of Environment, Parks and Protected Areas Program. In November 2005, the team reviewed detailed information presented by the forest districts and licensees adjacent to the Alberta border for the first time. The team provided advice, suggestions to improve processes and activities, generated reports, and assessed progress towards the performance measures set out in the Mountain Pine Beetle Emergency Response: Canada-B.C. Implementation Strategy www.for.gov.bc.ca/hfp/mountain_pine_beetle/can_bc_implement.htm).

The team also supports and develops a work plan required by the BC-Alberta Memorandum of Understanding. Funding from other sources within BC and Alberta that are targeted to spread control activities in these districts are part of the overview assessment to achieve efficient coordination of funding and results. Other strategies used to mitigate the spread of mountain pine beetle, such as harvesting, are reviewed for overall effectiveness also.

Since December 2006, the team provides monthly updates to all members and relevant parties.

Education and Awareness

Education, Increased Awareness and Training are important components of the mountain pine beetle (MPB) management program. Education and increased awareness of the MPB helped to provide a better understanding of this pest by the general public, policy makers, industry and other stakeholders. These activities were carried out at the provincial and Area levels.

After the large-scale immigration of MPBs in 2006 from BC into previously un-infested areas in Alberta, aerial detection of infested trees was not possible until faders appeared in 2007 in these areas. To determine the extent of the infestation the 310-BUGS hotline was established in 2006 so that the general public and workers of forest-based industries could report sightings of infested trees. To educate the public about the symptoms of MPB attack and to create awareness of the 310-BUGS hotline, pamphlets were mailed to many municipalities across the province who distributed them to all residents in their communities. A series of open houses, public information sessions and information booths were held in all Forest Areas, providing information on MPB, SRD's Management Plan and promoting the 310-BUGS hotline. For more details see the Area specific information below.

Provincially, SRD hosted and/or participated in a number of media events. As part of the Province's "Minister for a Day" program, five grade 5-7 students and their parents were accompanied by SRD's Minister David Coutts on a flight from Edmonton to Prince George on October 17, 2006. During the flight Erica Lee gave the students an orientation to the MPB epidemic in Alberta. In Prince George, Greg Rawling, Prince George District Manager, British Columbia Ministry of Forests and Range briefed the students on the magnitude of the epidemic in British Columbia, the causes of the epidemic, steps being taken jointly by British Columbia and Alberta to address the epidemic's spread and programs to salvage the damaged timber before losing value. After flying to Grande Prairie, Mike Maximchuk gave the students a tour of infested areas in Grande Prairie. At the end of the day the students gave their recommendations as "Ministers for a Day" on actions to curb the spread of the beetle in Alberta. The event was captured by The Edmonton Journal, Edmonton Sun, Globe and Mail, Grande Cache Mountaineer, Canadian Press, CBC radio and TV, Global, CTV, a freelance radio (Let's Go Outdoors) and a freelance filmmaker.

On June 19, 2007 Dr. David Suzuki and a filming crew filmed cut-and-burn control of infested trees at High Prairie. This footage was part of filming for a two-part "Nature of Things" segment on climate change to air in November 2007. The film included interviews with Dr. John Spence (University of Alberta), Dr. Allan Carroll (Canadian Forest Service) and Erica Lee (SRD).

Reporters from four Edmonton TV outlets, four local radio stations, and four newspapers (*The Edmonton Journal, Grande Prairie Daily Herald Tribune, Calgary Herald and Beaverlodge Advertiser*) attended a media event SRD organized in Grande Prairie on July 19, 2007. The intent was to showcase joint efforts by SRD, industry and municipalities. Footage included SRD crews conducting MPB surveys near Graham Base and municipal control action in Evergreen Park in Grande Prairie. The media interviewed Erica Lee (SRD), Jerry Bauer (municipal MPB planner), Roger Loberge (Weyerhaeuser), Jim Stephenson (Canfor), Grant Williamson (Ainsworth), Parker Hogan (AFPA), Dan Piercy (Chamber of Commerce). SRD made three helicopters available which took the reporters on a flight touring sites of infested trees with red foliage.

SRD, along with the Forest Engineering Research Institute of Canada, hosted a technical information session on May 11 at the 2007 Northern Forestry Show in Grande Prairie. The Northern Forestry Show is organized by a small group of volunteers and features information seminars, displays and networking opportunities for the forest industry and the general

public. The session provided the forest industry, contractors, provincial agencies, and the general public with an update on the current MPB situation; insights into operations within MPB affected stands; and a forum for discussion.

A Hydrology Workshop, held on October 13 in Calgary, brought together provincial government employees, industry workers and academics to discuss impact of the mountain pine beetle infestations on groundwater, run-off, and ultimate quality and quantity of water available for downstream users. The event was hosted by SRD.

As a member of the Strategic Directions Council (SDC - composed of Parks Canada, British Columbia Parks, British Columbia Ministry of Forest and Range, SRD, Alberta forest industry, Canadian Forest Service, and Alberta Tourism, Parks and Recreation) SRD also has a brochure that provides information on mountain pine beetle and its potential impact on Alberta. This group also produced a key tag that describes the mountain pine beetle and provides photographs and descriptions on how to detect an infested pine tree.

Areas

Peace River and Upper Hay Areas

In 2006/07, Mike Maximchuk (Forest Health Officer) and Natalie Henneberrry (Forest Health Technician) made many presentations to increase MPB awareness in these Areas. These presentations were made to participants (councillors, agricultural fieldmen, seasonal staff, other stakeholders) of the Municipal Districts (MD) and towns taking part in the MPB Grant Program (Northern Lights, Northern Sunrise, Fairview, Peace, Clear Hills, Town of Fairview and Town of Peace River). They also made presentations to SRD staff at the Area Conference, High Prairie Council, Junior Forest Wardens, and Junior Forest Rangers, members of the Alberta Trappers Association, Forestry Week attendees and students at Fairview High School. In addition, MPB information sessions were conducted for the benefit of stakeholders (farmers, land owners) in the Peace River area and attendees of various meetings between forestry and forest industry groups.

Mike and Natalie conducted several courses to train survey contractors and auditors in these Areas. They also supported training courses conducted at Grande Prairie and Worsley.

Foothills Area

Brooks Horne (Forest Health Officer) and Christy Messier (Forest Health Technician) conducted MPB information sessions for Area SRD staff, the general public and other stakeholders. SRD personnel at these sessions were staff at the Whitecourt Area Office, Wildfire Information Officers, Wildfire Crews (HAC and RAP), Type I Wildfire Crew Leaders and Junior Forest Rangers. The industry groups included Oil and Gas Workers, Edson Community Timber Permit (CTP) holders, staff of Foothills Forest Products; Hinton Wood Products; Sundance Forest Industries; Weyerhaeuser Edson and their contractors. Other stakeholders at these sessions were members of the Concerned Oil and Gas Citizens, Yellowhead County Shelterbelt/Woodlot Association, Cold Creek Loggers, Edson Fish and Game Association, and West Yellowhead Mountain Pine Beetle Coordination Committee.

The general public of the communities of Grand Cache, Hinton and Edson attended the public information sessions. Two Members of the Legislative Assembly (MLA) (Ivan Strang MLA and George Vanderberg MLA) also attended MPB Information Sessions.

Southern Rockies and Clearwater Areas

In these Areas, Christie Ward (Forest Health Officer) increased MPB awareness by making presentations at meetings, visiting Interest Groups and through media contacts (local newspaper, radio station). She made presentations to the general public (Information Sessions, Open Houses); Industry (Conoco Phillips,

R10 Timber Operators, Sundre Forest Products, Shell); Associations (Woodlot Association in Water Valley, Alberta Native Plants Council, Ghost and Red Deer Watershed Associations, National Forest Pest Association); Schools (three Junior High Schools); Aboriginal groups (Blood Tribe), Municipal District of Rockyview; and Scouts.

Lesser Slave Area

Throughout the year Dale Thomas (Forest Health Officer) made presentations to members of various organizations (Trappers Association, Boreal Forest Discovery Camp, SRD staff in Lesser Slave Area), conducted tours for local media and handled inquiries from the general public. These presentations covered MPB biology, identification and management strategies.

Lac La Biche and Waterways Areas

Tom Hutchison (Forest Health Officer) conducted information sessions to increase the awareness of MPB by external stakeholders (Integrated Forest Pest Management Group, AlPac Staff) and SRD staff (Lac La Biche and Waterways Area staff). He also held information sessions for the benefit of the general public, Junior Forest Wardens and Junior Forest Rangers. Tom handled many MPB inquiries from mass media personnel and the general public throughout the year.

Woodlands Area

Seena Handel (Forest Health Officer) conducted information sessions for various groups (SRD staff, school children, forest industry, oil and gas industry, trappers, community groups and the general public), made several presentations on MPB-related activities and provided weekly updates at the Trade Shows, community forums and meetings with forest industry. She also received feedback from these stakeholders on planned MPB activities. She coordinated mailouts with the County of Woodlands, and the Towns of Whitecourt, Swan Hills and Fox Creek.

Smoky Area

The Forest Health Officers, Dylan Wood and Devin Letourneau, and information officers promoted public awareness by providing MPB information at the Agri-Fair in Beaverlodge and Sexsmith, the Forest Show in Grande Prairie and a Woodlot Owners Meeting in Saskatoon Lake. During a tree pest workshop in Grande Prairie they provided public consultation on how to protect pine trees from MPB attack. SRD staff from the Smoky Area as well as Provincial Headquarters also provided information on the provincial MPB program to mass media by responding to media enquiries and hosting media events in Grande Prairie, Graham Base and Sherman Meadows Base.

Training

Ground Survey Course

The Forest Health Training and Operations Assistant, Anina Hundsdörfer, developed a course to train SRD staff, contractors, FMA holder employees and municipal employees how to conduct ground surveys for MPB, as well as baiting and control techniques. The course covered MPB life cycle, damage symptoms and ways to distinguish MPB from other similar bark beetles, as well as provincial procedures for ground surveys, baiting, control and population forecast surveys.

Every course participant received a field manual containing information on MPB biology and identification and the provincial procedures for ground surveys, baiting and Level I control (ASRD, 2006). Presentations and exercises in a classroom were followed by a written exam at the end of the day. The second day was spent in the field looking at damage symptoms and practising survey procedures. Several burn piles of varying control quality were established in the Training Forest of Cache Percotte near Hinton where students could observe and discuss control techniques. Students were tested in the field for their ability to identify MPB, apply the

survey procedures and to navigate in the forest. Successful participants of the course received a certificate and their names were entered into a provincial database for future reference. With the help of the Forest Health Officers, Forest Health Technicians and Information Officers, 26 courses were held during the 2006 beetle year with a total of 562 participants.

Aerial Survey Course

Sunil Ranasinghe (Forest Entomologist) and Anina Hundsdörfer (Forest Health Specialist) organized a 2-day course on Heli-GPS surveying MPB infestations. This course was conducted on May 23-25 in Canmore Alberta. The trainers were Sunil Ranasinghe (Forest Entomologist), Brad Tyssen (GIS Technologist), Anina Hundsdörfer (Forest Health Specialist), Tom Hutchison (Forest Health Officer) and a contractor. There were 24 trainees consisting of SRD employees and industry personnel. The course commenced with a half-day classroom session to cover beetle biology and use of a tablet personal computer linked to a global positioning system to record the survey results. This was followed by aerial survey training for half a day and an evaluation on the following day. Each participant was supplied with a MPB heli-GPS Manual containing procedures, pictures for identifying tree species from the air and discerning MPB damage from other mortality agents, as well as instructions for using the tablet PC (ASRD, 2007).

Alberta Forest Pest Outbreak Warning System

Spruce Budworm

Forest Health crews deployed Multi-Pher I (Le Group Biocontrole, Quebec) traps baited with the female spruce budworm sex pheromones (Phero Tech Inc., British Columbia) to monitor male moth populations. The procedure for deploying these traps is described in the *Spruce Budworm Management Guide* (Ranasinghe and Kominek, 1998). Figure 20 shows the results of these surveys.

Spruce budworm pupa

Northeast Alberta

The results of male spruce budworm moth surveys are summarized in Table 13.

In the Lac La Biche Area 28 plots were established. Average trap catches indicated risk of new outbreaks occurring in 2008 was low in 7 plots (25%),

Table 13
Summary results of spruce budworm male moth surveys carried out by using pheromone-baited traps in northeast Alberta, 2007.

Area	Risk of New Outbreaks Occurring in 2008					
	Low		Moderate		High	
	No. of Plots	Moths/trap	No. of Plots	Moths/trap	No. of Plots	Moths/trap
Lac La Biche	7	163-460	15	597-1971	6	2044-2974
Waterways	1	338	8	618-1921	13	2213-5272

Figure 20

Forecast based on male moth catches in 2007 on risk of new spruce budworm outbreaks occurring in 2008 in Alberta.

moderate in 15 plots (54%) and high in 6 plots (21%). In comparison, only 7% of the plots indicated high risk of new outbreaks occurring in 2007. Thus the risk of new outbreaks occurring in 2008 has increased compared to that in 2007. Overall, the risk of new outbreaks occurring in 2008 is moderate to high in this Area.

In the Waterways Area, 22 plots were established. Average trap catches indicated risk of new outbreaks occurring in 2008 was low in 1 plot (5%), moderate in 8 plots (36%) and high in 13 plots (59%). Overall, the risk of new outbreaks occurring in this Area in 2008 remains high.

Northwest Alberta

Summary of 2007 male spruce budworm moth survey results and the risk of new outbreaks occurring in 2008 are shown in Figure 20 and Table 14.

In the Smoky Area trap catches in all the plots indicated low risk of outbreaks occurring in 2008.

In the Lesser Slave Area, the average trap catches indicated that the risk of new outbreaks occurring in 2008 was low in 5 plots (71%) and moderate in 2 plots (29%). The overall risk of new outbreaks occurring in this Area in 2008 is low.

In the Peace Area, the average trap catches indicated nil to low risk of outbreaks occurring in 2008.

In the Upper Hay Area, risk of new outbreaks occurring in 2008 was low in 58% of the plots, moderate in 37% of the plots and severe in 5% of the plots. Compared to the survey forecast for 2007, these numbers indicate an increase in the risk of new outbreaks occurring in 2008. The overall risk of new outbreaks occurring in this Area in 2008 is low to moderate.

Southwest Alberta

Nineteen plots were established in southwest Alberta as shown in Table 15.

Most of the plots in southwest Alberta are infested with the two-year cycle spruce budworm, i.e., high moth catches are expected in alternate years. In 2006 relatively high catches occurred in plots with the two-year cycle spruce budworm.

Table 14
Summary results of spruce budworm male moth surveys carried out by using pheromone-baited traps in northwest Alberta, 2007.

Area	Risk of Outbreaks Occurring in 2008					
	Nil - Low		Moderate		High	
	No. of Plots	Moths/trap	No. of Plots	Moths/trap	No. of Plots	Moths/trap
Smoky	9	4-191	0	-	0	-
Lesser Slave	5	0-332	2	924-1453	0	-
Peace	21	0-325	0	-	0	-
Upper Hay	53	0-495	33	549-1970	5	2212-3234

Table 15
Summary results of spruce budworm male moth surveys carried out by using pheromone-baited traps in southwest Alberta, 2007.

Area	Risk of Outbreaks Occurring in 2008					
	Nil - Low		Moderate		High	
	No. of Plots	Moths/trap	No. of Plots	Moths/trap	No. of Plots	Moths/trap
Southern Rockies	8[1]	199-463	0	-	-	-
Clearwater	4	53-474	2	567-772	0	-
Foothills	8	18-188	0	-	0	-
Woodlands	5	0	0	-	0	-

[1] Two plots in western spruce budworm stands

Consequently, relatively low moth catches were expected to occur in these plots in 2007.

In the Southern Rockies Area, trap catches in six plots forecasted nil to low risk of new outbreaks occurring in 2009. The other two plots located in stands infested with the western spruce budworm also had similar trap catches. In the Clearwater Area, trap catches at four out of six plots were indicative of nil to low risk of new budworm outbreaks in 2009. Traps in two plots had moth counts indicative of a moderate risk of outbreaks occurring in 2009. In the Foothills and Woodlands areas the trap catches indicated nil to low risk of new outbreaks occurring in 2009 (Figure 20 and Table 15). Overall, southwest Alberta has a low to moderate risk of new outbreaks occurring in 2009.

Western Spruce Budworm

An egg mass survey was carried out to predict the severity of defolaition occurring in 2008. The sampling procedure is described in Ranasinghe (2007); this procedure was based on a publication by the B.C. Ministry of Forest and Range (1995). Ten sample plots were established and the average number of new egg masses per 10 m2 of foliage were calculated. Figure 21 illustrates the results of this survey. The egg mass counts indicated likelihood of severe defoliation occurring in 80% of the plots in 2008. Severe defoliation is expected in 2008 in most of the currently infested areas.

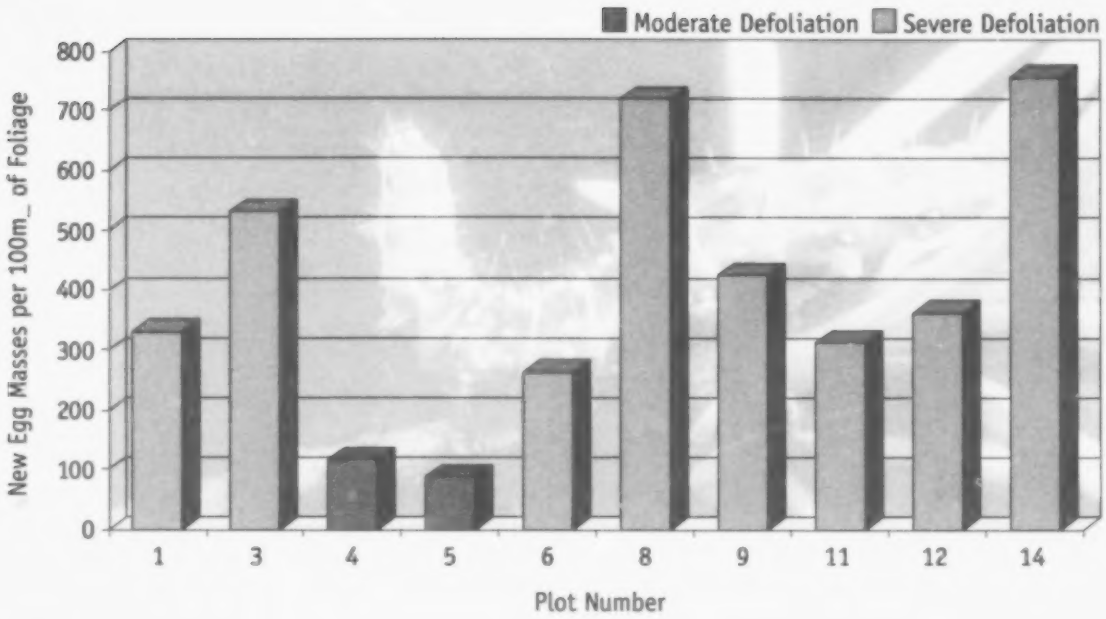


Figure 21
Forecast on western spruce budworm defoliation severity in sample plots in 2008 based on a survey of new egg masses carried out in the fall of 2007 in Porcupine Hills, Alberta.

Mountain Pine Beetle

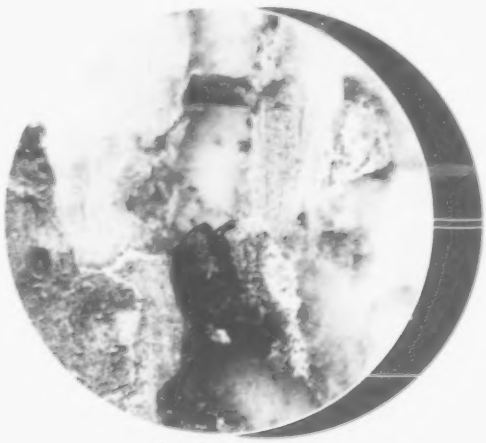
To assess the natural growth trends of MPB populations in Alberta, province-wide population forecast surveys were conducted in the spring of 2007. Samples were collected from 1419 infested trees at 255 sites. R-values (the ratio of the adults that entered a tree to the living brood), a measure of MPB population growth, were calculated from these samples. Since climate deemed to be the most important natural factor limiting MPB population growth in Alberta, a sampling strategy was devised to capture the variation of climatic conditions in the infested areas of the province. A climate suitability model, developed by Dr. Allan Carroll and his co-workers (Carroll *et al.*, 2004), was used to develop the sampling strategy. This model, based on historical and current weather data, indicates an area's suitability to MPB development. In each climatic zone identified by the model fifteen to twenty plots were set up. Other considerations included the number of infested trees per site, spatial coverage and site access. Due to inconsistencies in determining mortality of eggs and some larvae the R-values calculated were not exact. However, these are the best estimates of the relative growth of MPB populations in the province.

In general, MPB populations in the south showed very high R-values (Table 16, Figure 22). Thus, if no control program had been undertaken, the 2007/2008 MPB generation in the south was to be significantly larger than the 2006/2007 generation. In northern Alberta, population growth was much lower than in southern Alberta. Overall, barring immigration of MPB, these northern populations may either remain static or decline in the next generation.

Table 16
Summary statistics for R-values from spring 2007 by Area.

Area	Site-level R-values		SD between sites	SD within sites	
	mean	max		mean	max
Southern Rockies	3.58	18.50	5.01	3.14	20.51
Foothills	0.31	2.78	0.56	0.63	3.91
Slave Lake	0.46	6.50	1.27	0.22	4.31
Smoky	0.52	5.00	0.87	0.81	5.87
Peace	1.14	4.33	1.29	1.67	5.93
Provincial	1.02	18.50	2.40	1.11	20.51

The geographic variation in R-values can be largely explained with winter survival of MPB. The predictions (Barry Cooke, personal communication) based on a winter-kill model (Régnière, Bentz & Cooke 2007, privileged communication) showed a good fit to the large-scale trend of the empirical data. However, within each Area, R-values varied greatly between regions and between individual trees (Table 16). Other factors that could contribute to population trends include microclimatic conditions, host resistance, phloem thickness, attack density, beetle fitness, competition with other bark beetles, predation, disease, stand conditions, drought and genetics.



MPB in a bark tube

The large-scale pattern in green-to-red ratios was consistent with the R-value trends; high ratios in southern Alberta and overall lower ratios in the northern Alberta.

Figure 22
Forecast on mountain pine beetle population trends in 2007/2008 based on R-values collected in May 2007, Alberta

The large-scale pattern in green-to-red ratios was consistent with the R-value trends; high ratios in southern Alberta and overall lower ratios in the northern Alberta.

Figure 22
Forecast on mountain pine beetle population trends in 2007/2008 based on R-values collected in May 2007, Alberta

Forest Tent Caterpillar

An egg mass survey was carried out in the fall of 2007 to predict the severity of forest tent caterpillar defoliation in the Waterways Area in 2008. This survey was carried out in collaboration with the Municipality of Wood Buffalo. The sequential sampling procedure used was described in Ranasinghe (2007). Several aspen stands in the Waterways Area were surveyed by using this procedure. The survey results indicated possible occurrence of severe forest tent caterpillar defoliation in most of the surveyed stands in 2008 (Figure 23).

Gypsy Moth

The Forest Health Section coordinated deployment of 65 pheromone-baited Delta traps to detect gypsy moths in the Green Zone. The traps and the procedures were provided by the Canadian Food Inspection Agency. Traps were deployed at high risk locations across the Green Zone. No gypsy moths were detected in the traps deployed by SRD. The risk of a gypsy moth infestation occurring in 2008 in the Green Zone is nil.

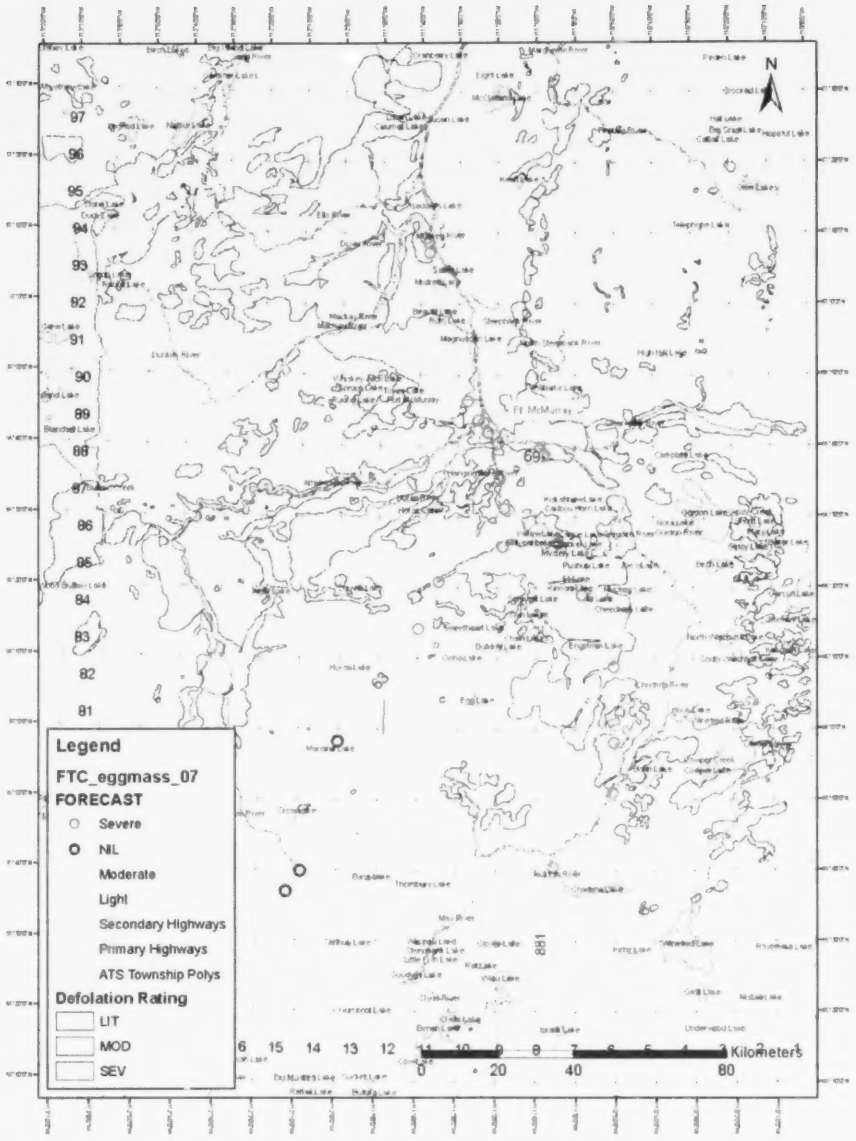


Figure 23
Map showing sampling locations with high egg mass counts that indicate severe forest tent caterpillar defoliation in 2008 in northeast Alberta.

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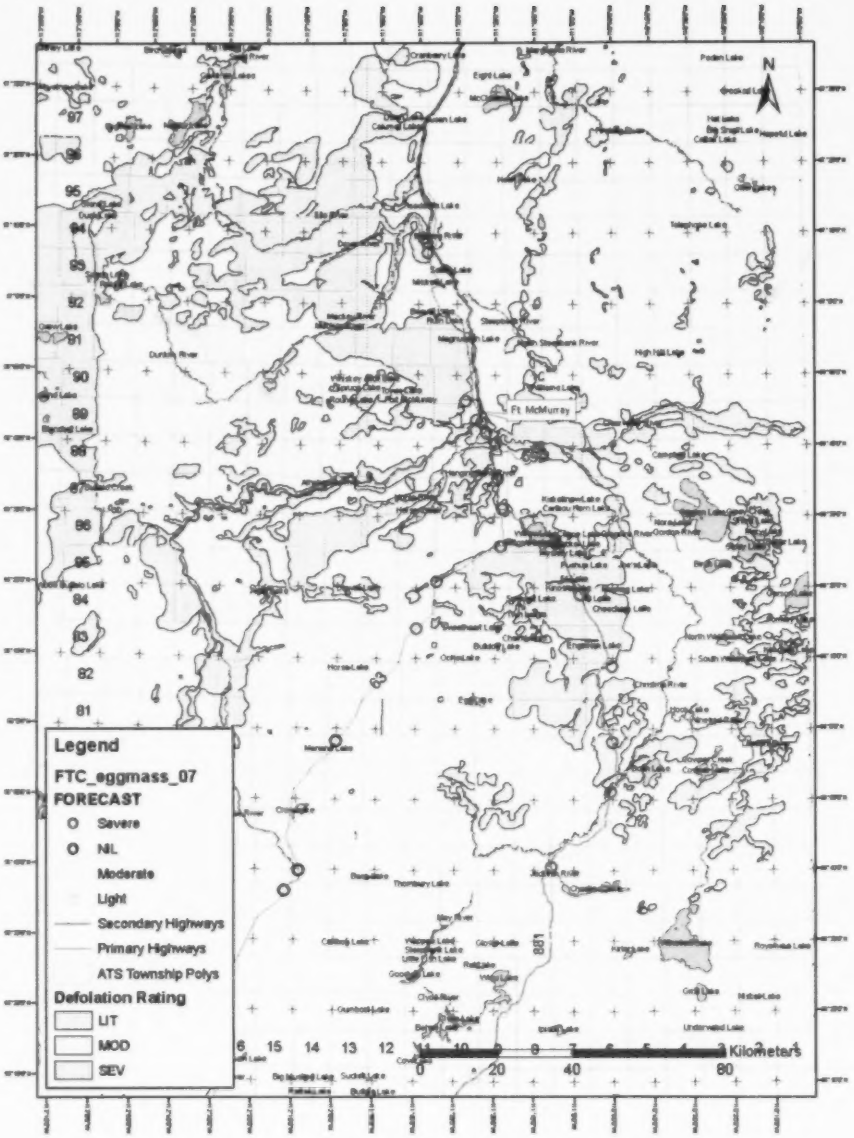

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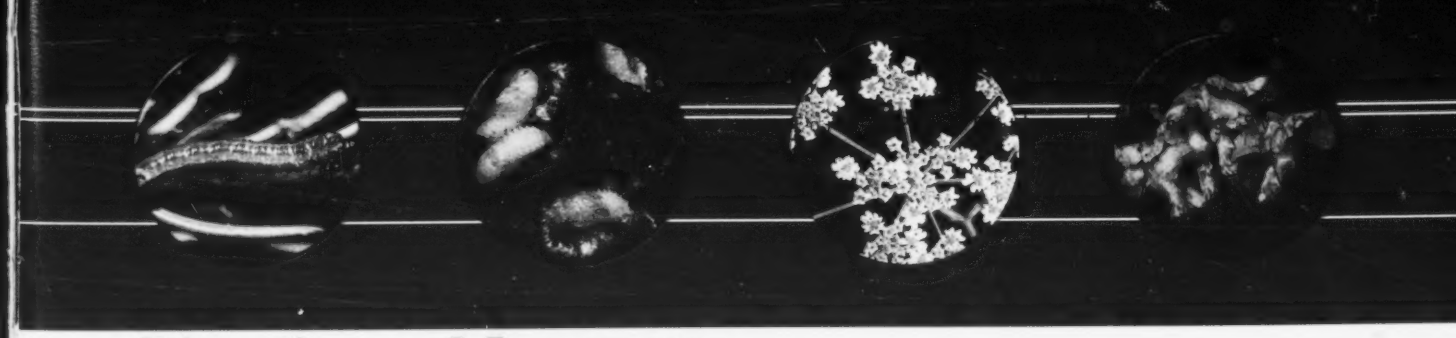


Education and Awareness

Annual Report

The Forest Health Section published the 10th annual report in 2007. In 1997, this report succeeded the Forest Insect and Disease Survey Report published by the Northern Forestry Centre, Canadian Forest Service, Natural Resources Canada. The Forest Health Annual Report contains details on forest insect, disease and invasive species surveys, operational programs, research, education and increased awareness on forest health issues.

Bugs and Disease Newsletter

Three issues under the 17th Volume of this Newsletter were published in 2007. This publication covered numerous aspects of Alberta's Forest Health-related news, stories and poems. This informative publication has a Canada-wide circulation.

Beetle Bulletin

The Beetle Bulletin allows SRD to update the public on the mountain pine beetle situation, particularly on research initiatives, provincial operation updates, upcoming events and other important mountain pine beetle news. This publication has a readership varying from highly invested stakeholders to those new to the MPB story.

The Beetle Bulletin recommenced distribution in December 2007 after a six month hiatus. The publication is now distributed on a monthly basis as an e-newsletter that is delivered to subscriber email accounts via a website program called My Industry Mailout. Through an online reporting system SRD can assess factors such as which articles are being read the most to how many times the Bulletin is being forwarded on by a subscriber.

The publication is user-friendly as readers can subscribe via the internet or unsubscribe straight from the newsletter. Recipients of the publication are also able to forward the publication on to other people who can then choose to subscribe with a simple press of a button.

Provincial Integrated Forest Pest Management Forum

The 11th annual Integrated Forest Pest Management Forum was held on November 6, 2007 at the Northern Forestry Centre, Canadian Forest Service in Edmonton. This event was attended by representatives of the SRD, British Columbia Ministry of Forest and Range, Municipalities, Canadian Forest Service, academia and forest industry. The keynote address entitled "Murder and Attempted Murder: Mountain Pine Beetle Attacks Two Species of Spruce in Interior British Columbia" was delivered by Robert Hodgkinson, Regional Forest Entomologist, Prince George, British Columbia Ministry of Forest and Range. Other presentations at this forum covered updates on forest health conditions in provincial forested Crown land and national parks in Alberta; and, forest health-related research carried out in 2007 in Alberta.

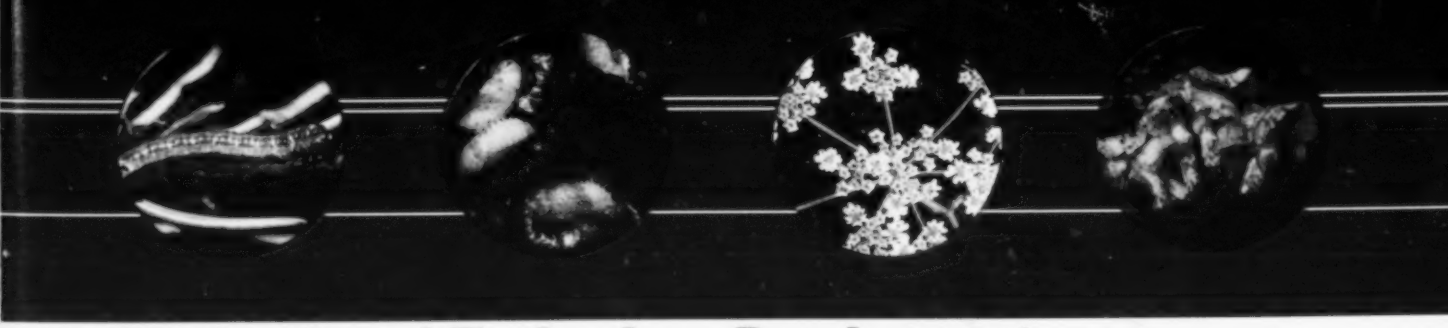
15th Annual Alberta/British Columbia Intermountain Forest Health Workshop

This two-day workshop was held from April 17-18, 2007 in Hinton, Alberta under the auspices of Natural Resources Canada, Canadian Forest Service, Northern Forestry Centre. An update of forest pest conditions in Alberta and British Columbia was followed by a session on current MPB research. The agenda included a session on whitebark pine conservation and another on invasive plants. Dr. Jan Volney made a thought-provoking presentation on "Assessing Sustainability of Canada's Forests." The proceedings of this Workshop are posted on:
http://abbcforesthealth.blogspot.com/search

Workshops

The department co-hosted with the Sustainable Forest Management Network, Foothills Model Forest and College of Alberta Professional Foresters a workshop on understanding the hydrological implications of mountain pine beetle and salvage logging in October 2007. Speakers included specialists from British Columbia and the United States.

The department hosted a forest succession workshop in June 2007 which brought together various experts in stand dynamics to develop a common understanding of stand succession in beetle killed stands of pine.



Research and Technology Development

Mountain Pine Beetle

In 2006 and 2007 SRD provided either full or partial funding for MPB research projects within and outside of the Forestry Division. Approximately $1.6 million was committed to fund 15 applied research projects to increase MPB biology and ecological knowledge on the forest landscape. The Forestry Division also provided in-kind support (use of helicopters, camps and other Sustainable Resource Development facilities) for some researchers. The projects were coordinated through a variety of methods including; involvement on the Board of Directors (FRIAA), National Centre of Excellence, Foothills Research Institute and as members on committees such as the Strategic Direction Council. The Forest Economics Branch led research aimed at forest products and chemical attributes of beetle affected wood. The Branch participated on several sub committees with Advanced Education and Technology, coordinated the cross Ministry Assistant Deputy Minister's Working Group and with Employment, Immigration and Industry on community sustainability.

Funding requests originated from the Alberta Research Council, Canadian Forest Service (CFS), Natural Resources Canada, SERG International, Universities and companies. Details of major Sustainable Resource Development funded projects:

- Mountain Pine Beetle Genomics: Project contributors are Genome British Columbia, Genome Alberta, Alberta Sustainable Resource Development, Alberta Forest Research Institute and the University of Alberta. This is a multi-million dollar, long term, large-scale research project aimed at studying the genome of the mountain pine beetle, lodgepole pine and the blue-stain fungi associated with the mountain pine beetle. The main collaborators are the University of Alberta and Genome British Columbia in close association with the University of British Columbia. The objectives are to study genome and its environmental interactions and to create genetic landscape maps of the host tree species, beetle and the blue-stain fungi. This knowledge may help to develop beetle-resistant pine trees and to understand the dispersal history of MPB populations.
- Southern Rockies Watershed Project: This project is led by Dr. Uldis Silins originally investigating the effects of wildfire on water quality and quantity. It has been extended to allow future investigators to address issues related to mountain pine beetle salvage and water quality.
- Foothills Model Forest and University of Alberta-MPB Hydrology Study: This five-year study addresses hydrological questions at the stand level is led by Dr. Uldis Silins. The research team includes Dr. Ellen MacDonald of the University of Alberta and researchers Rita Winklar and David Spittlehouse in British Columbia.
- Overwintering mortality model: Dr. Barry Cooke, CFS validated an overwintering mortality model developed for Utah to local conditions in Alberta. His group monitored MPB mortality in relation to winter temperatures in Alberta and compared model predictions with observed MPB mortality. The goal for next year is to develop a map with predictions on overwintering MPB mortality as a decision-support tool for MPB operations.

- Impact of MPB on woodland caribou: Debbie Cichowski from Caribou Consulting conducted a literature review to identify research gaps and make suggestions for future research on the impact of MPB on woodland caribou in Alberta.
- Risk of colonization of jack pine by MPB and phytopathogenic Ophiostomoid fungi: Dr. David Langor and his coworkers (CFS, Edmonton) tested host suitability of jack pine for MPB and associated phytopathogenic fungi.
- Transport and waste disposal options for MPB-infested pine wood in Alberta: Forest Engineering Research Institute of Canada (FERIC) reviewed related literature and compiled a document containing acceptable methods for transport of MPB-infested wood in Alberta and for disposal of wood waste after processing infested wood at sawmills.
- Impact of MPB-related harvesting operations on grizzly bear habitats in Alberta: Gordon Stenhouse (Foothills Model Forest) studied changes in grizzly bear habitat use in areas harvested to control the MPB in Alberta. Field work is ongoing.
- Modelling effects of removing selected forest stands on MPB dispersal: Andrew Fall (Gowlland Technologies Ltd.) and his co-workers developed a predictive model that will help SRD to refine the implementation of the Pine Strategy to slow the spread of the MPB infestation.
- Composting as a method of infested wood disposal: Dr. Mike Hamilton (Olds College School of Science and Innovation) monitored the winter temperature profile of standard and composted pine wood waste piles in Alberta. His results suggest that temperatures in a compost pine are high enough to kill MPBs. Hence, composting may be an option in dealing with small amounts of MPB-infested wood waste. This is especially useful for small sawmill operators in Alberta.
- Long-range dispersal of MPB over the Rocky Mountains: Dr. Peter Jackson et al. (UNBC) investigated the feasibility of using Doppler radar to detect and track airborne MPB heading over the Rocky Mountains from British Columbia to Alberta. The project involved aerial capture of MPBs and the use of radar to develop trajectories to predict locations where MPBs are likely to land in Alberta.
- Snow-caching MPB infested logs: Richard Krygier (CFS Edmonton) investigated the possibility of building snow caches over wood piles in the winter and slowing down MPB development while keeping wood fresh for processing later in the season. Results suggest that snow caches may be a viable and effective option for prolonging storage of MPB-infested logs.

SRD conducted internal research in its commitment to use the most efficient and effective methods for MPB operations. Mechanical treatment of wood infested with other insects has been effectively used for phytosanitary treatment of wood infested with other wood boring insects. The use of chippers, mulchers, grinders and debarkers for treating wood infested with MPB was potentially a cost-effective and time-efficient mechanical alternative to fire on specific locations. However, these technologies had never been tested for their effectiveness at killing MPB. Hence, Anina Hundsdörfer and other Forest Health staff conducted a study to identify a chip size where the risk of MPB survival was minimized to an acceptable level. In the summer of 2007 three heavily infested lodgepole pine trees were chipped into chips of 2.9 - 10.2 centimetre diameter and the number of emerging beetles counted daily. The study demonstrated that MPB survival in chips is reduced to an acceptable level in chips 5.1 centimetre or smaller. Provincial quality inspection procedures for chips from level 1 treatment of infested trees were generated based on this threshold chip size.

Technology

During the year, Forest Health Section compiled the following documents to transfer technology on Forest Health:

1. Forest Tent Caterpillar Egg Mass Survey to Predict Defoliation Severity in the Following Year (Ranasinghe, 2007).
2. Guide for Sampling Western Spruce Budworm Infested Stands to Predict Defoliation Severity in the Following Year (Ranasinghe, 2007).

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Appendixes

Appendix I

Alberta Sustainable Resource Development Corporate Areas, December 2007.

Appendixes

Appendix I

Alberta Sustainable Resource Development Corporate Areas, December 2007.

Appendix II

Information on Operational Use of Pheromones in Alberta, 2007.

Forest Tent Caterpillar

Chemical component(s):	Z5, E7 – dodecadienal
Lure type:	Flexlure®
Trap type:	Uni-trap®
Pheromone source:	Phero Tech Inc., Delta, British Columbia

Gypsy Moth

Chemical component(s):	(+)cis-7, 8-epoxy-2-methyloctadecane
Lure type:	Disparlure®
Trap:	Delta sticky trap
Pheromone source:	Trécé Inc., Salinas, California (purchased and distributed by Canadian Food Inspection Agency)

Mountain Pine Beetle

Chemical component(s):	trans-verbenol, exo-brevicomin
Lure type:	Pre-packed tree-bait
Trap:	not applicable
Pheromone source:	Phero Tech Inc., Delta, British Columbia

Spruce Budworm

Chemical component(s):	95% E-11-tetradecenal, 5% Z-11-tetradecenal
Lure type:	Plastic lure
Trap type:	Multi-Pher I®
Pheromone source:	Phero Tech Inc., Delta, British Columbia

Appendix III

Common and Latin Names of Invasive Plant Species that Occurred in Alberta in 2007.

Bladder campion - *Silene cucubalus* Wibel

Blueweed - *Echium vulgare* L.

Bull thistle – *Cirsium vulgare* (Savi.) Ten.

Canada thistle - *Cirsium arvense* (L.) Scop.

Cleavers – *Galium aparine* L.

Common tansy - *Tanacetum vulgare* L.

Common toadflax - *Linaria vulgaris* Hill.

Dalmatian toadflax – *Linaria dalmatica* (L.) Mill.

Field bindweed – *Convolvulus arvensis* L.

Field scabious - *Knautia arvensis* (L.) Duby

Hound's tongue - *Cynoglossum officinale* L.

Knawel - *Scleranthus annuus* L.

Leafy spurge - *Euphorbia esula* L.

Orange hawkweed - *Hieracium aurantiacum* (L.)

Ox-eye daisy - *Chrysanthemum leucanthemum* L.

Perennial sow-thistle - *Sonchus arvensis* L.

Scentless chamomile - *Matricaria perforata* Merat.

Spotted knapweed – *Centaurea maculosa* Lam.

Tall buttercup - *Ranunculus acris* L.

White cockle - *Silene alba* (Mill.) E. H. L. Krause

Wild caraway – *Carum carvi* L.